THE PERSONALIZED SYSTEM OF INSTRUCTION: FIDELITY AND EFFECT ON HEALTH-REALTED FITNESS KNOWLEDGE AND IN-CLASS PHYSICAL ACTIVITY

by

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STATEMENT OF DISSERTATION APPROVAL

The following faculty members served as the supervisory committee chair and members for the dissertation of Steven L. Prewitt.

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ABSTRACT

Levels of physical activity and health-related fitness (HRF) are decreasing among adolescents in the United States. Several interventions have been implemented to reverse this downtrend. Traditionally, physical educators incorporate a Direct Instruction (DI) strategy when teaching, potentially leading students to disengage during class. An instructional strategy that has been shown to be effective in increasing content knowledge and skill competency in physical education is the Personalized System of Instruction (PSI). A two-study approach was used to investigate: (a) the fidelity of using PSI to teach HRF content knowledge and resistance training skills in a high school physical education class, and (b) examine changes in HRF content knowledge and in-class physical activity levels with a class using PSI compared to a similar class using DI. Students (*N*=54) from a private, urban high school in a major city within the Mountain West region of the United States participated in the 6-week study. Video and audio taping, along with interviews and journals, were used to determine if criteria standards associated with PSI were met. Knowledge was assessed three times (pre, post, 3-week follow-up) using a standardized HRF knowledge test. Scores were compared between the two groups in addition to changes within each group. Class time physical activity was measured using a modification of the System for Observing Fitness Instruction Time (SOFIT). Study

results showed that 3 of the 4 components of PSI were met as well as 10 of 12 design features, suggesting that implementing the personal fitness unit using PSI was successful. Knowledge results showed that the PSI group demonstrated a significant increase in knowledge assessment scores from pre- to posttest (p=0.003). Between-groups results showed that after the 6-week study, HRF knowledge scores from the PSI scores were significantly higher than those from the control group (p=0.03). Differences in physical activity between the two groups were not significant (p=0.79). These results suggest that PSI is a successful instructional model for increasing HRF knowledge while maintaining physical activity levels. With its characteristics of self-pacing and mastery learning, PSI has the potential to be an effective teaching model within physical education.

I would like to dedicate this dissertation to my father,

who taught me about hard work, dedication,

and how to approach life differently.

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CHAPTER 1

Introduction

For the majority of adolescents, physical education classes provide the best environment for increasing activity levels and, thereby, personal fitness levels (Morena Muricia, Coll, & Perez, 2009; Pate, Ward, O'Neill, & Dowda, 2007; Sallis et al., 2012). Yet reports show that there is a significant decrease in the participation in physical education classes between 8th grade (91%) and 12th grade (34%) (CDC, 2011; Johnson, Delva, & O'Malley, 2007). Traditionally, secondary physical education teachers utilize a direct instruction model (DI) to teach traditional sports activities, such as flag football, basketball, and soccer (Bauman, 2009). Trudeau and Shepard (2005) have suggested that the reported decrease in participation in physical education is not attributed to a loss of interest in physical education, but is more likely caused by the format or structuring of the class.

It is suggested that some instructional models may be more effective for maintaining physical activity during physical education classes than others. Several have also reported decreases in both motivation towards physical education (Olafson, 2002; Osborne, Bauer, & Sutliff, 2002; Parish & Treasure, 2003; Whitehead & Biddle, 2008) and perceived relevance (Saffici, 1999; Webster, Mindrila, & Weaver, 2011) of what is being taught. Furthermore,

Slingerland and Borghouts (2011) have stated that physical education can have a direct and indirect influence on fitness levels of children and adolescents by engaging in health-related fitness (HRF) within class and instructing HRF to understand the benefits of physical activity (PA) outside of class. As knowledge increases, adolescents can have a better understanding of a healthy life and what it takes to engage in true activity. Ennis (2012) has suggested that knowledge, coupled with the appropriate applications, could be the first steps needed to combat the decline in PA within physical education classes. The author continues and suggests that increases in knowledge can off-set negative beliefs about fitness ("If my heart beats too fast, I will have a heart attack," p. 14), which can lead to decreases in PA. To assist students in becoming more active during physical education class, teachers need to be prepared to address students' needs with appropriate instructional strategies (Bryan & Solomon, 2012).

While DI has been utilized successfully within physical education for many years, decreases in student motivation, participation, and HRF have demonstrated a need to examine other potential instructional strategies. It is suggested that physical education teachers need to transition from the direct, teacher-centered methods of teaching and incorporate more indirect, pupil-centered instructional strategies (Curtner-Smith, Todorovich, McCaughtry, & Lacon, 2001). Therefore, the following proposal will investigate the implementation of a personal fitness unit by using the Personalized System of Instruction (PSI) model. This dissertation will follow a two-paper format. The aim

of study one will be to conduct a feasibility study examining the implementation of a personal fitness unit using PSI. The aim of the second study is explore changes in HRF knowledge and examine potential changes increases in PA between students in a DI class and a PSI class.

Instructional Models

There are currently eight common instructional models that have been shown to be effective in teaching physical education (Metzler, 2005). These include direct instruction, cooperative learning, sport education, tactical games, peer teaching, inquiry teaching, teaching for personal and social responsibility, and PSI, with direct instruction the predominate method currently in practice. Direct instruction (DI) is a teacher-centered approach where the instructor determines the majority of the content of the lesson and class, and how much a student is involved in participation (Mendez, Valero, & Casey, 2010). Traditionally, a DI lesson consists of a combination of six components: 1) review of previous work, 2) presentation of new material, 3) student practice, 4) feedback, 5) independent practice, and 6) periodic reviews (Rosenshine, 1983, p. 338). It is suggested that DI is an appropriate strategy to use when basic skill development and safety issues are of highest importance (Sweeting & Rink, 1999).

DI should not be confused with direct teaching strategies, which are employed even amongst the most student-centered models. The key separation between them is DI is based upon a series of defined steps, engagement

patterns, and decisions by the teacher (Metzler, 2005). When implemented correctly DI can provide the environment needed for increases in skill of activity (Ayers et al., 2005; Rikard & Boswell, 1993; Sweeting & Rink, 1999). The DI model requires the teacher to have higher expertise and to have control over the progression of the lesson, including assessment, practice time, and tasks. A negative aspect of DI is a lack of autonomy on the students' part. With the teacher as the director of the lesson, there is little input from the students. Sodeman and Smith (2010) reported that student perceived autonomy remained low during a weight training unit that utilized DI even when choice was integrated in the activity.

Personalized System of Instruction

The PSI model was originally designed by Dr. Fred Keller in the early 1960s to replace traditional lecturing and incorporate an independent, modular approach to learning (Keller, 1968). At the time, Dr. Keller was teaching a general psychology course at the University of Sao Paulo in Brazil. Upon entering the lecture hall and looking at the 300-plus students attending, Dr. Keller had doubts that the traditional, lecture-based curriculum model would work. As a contemporary of B.F. Skinner, Keller hypothesized the concept that students will learn, with or without the instructor. His thoughts were that the professor/instructor should concentrate more on helping students through personal feedback. Mastery of the subject was the responsibility of the student.

The “Keller Plan,” as PSI is sometimes referred to, has five distinct characteristics:

1) The course is self-paced. Students are allowed to progress as fast as they want or as slow as they need (Metzler, 2000). The self-pacing of the student is determined by the experience of the student and the external demands of life.

2) The outcome consists of “Mastery learning.” The student may progress to the next unit or module only when they have demonstrated mastery of the current subject. This usually takes the form of a written assessment, but can be another form of assessment approved by the instructor.

3) The teacher acts as a motivator, as opposed to the source of information. Traditionally, emphasis was placed upon the teacher’s knowledge being passed on to the student. It still is, but in a different form (see characteristic #4).

4) The emphasis is placed on the written word for materials and learning. This is usually in the form of a workbook or, in the 21st century, by the use of an electronic device, and

> 5) Proctors are used for a majority of assessment. This allows for students to repeat assessments if needed, quick feedback, and possible explanations of assessments. (Keller, 1968)

Since the mid-1960s, the PSI has been used throughout the educational domain with tremendous success (Bangert, Kulick, & Kulick, 1983; Calhoun, 1977; Fell, 1989; Grant & Spencer, 2003; Hannon, Holt, & Hatten, 2008; Johnson & Croft, 1975; Kulick, Kulick, & Cohen, 1979; Pritchard, Penix, Colquitt, & McCollum, 2012; Springer & Pear, 2008). In the 1970s, research on PSI suggested that it would replace or at the least be comparable to traditional lecture in higher education (Taveggia, 1976). During the 1980s, the use of PSI declined, but started to see more and more implementation during the 1990s. With the current trend of on-line and Web-based learning, PSI has again shown its legitimacy within education (Grant & Spencer, 2008).

Several studies from a wide variety of fields have highlighted the effectiveness of PSI as a legitimate mode of teaching ranging from psychology (Calhoun, 1977; Johnson & Croft, 1975: Springer & Pear, 2008), nurse education (Fell, 1989), distance education (Grant & Spencer, 2003), and physical education (Hannon, Holt, & Hatten, 2008; Pritchard, Penix, Colquitt, & McCollum, 2012) courses. Ocorr and Osgood (2003) compared a lecture-based approach to a self-paced PSI strategy in a standard biochemistry course. The course had been implemented and used for the previous 8 years. Surveys completed at the end of the semester demonstrated that students measured students' perceptions of

the two courses. Students from the PSI course rated the overall learning of the course higher than the traditional course (p=0.002). However, there was no significant difference in the perception of increased workload.

Hambleton, Foster, and Richardson (1998) compared PSI and a conventional lecture style in a discrete mathematics course. The two groups investigated consisted of mathematics majors and computer science majors. Math majors in the PSI cohort showed significant increases in content knowledge compared to their counterparts in the lecture-based class (p<0.025). A significant difference was also observed between the two curriculum styles in regards to comprehension learning (p<0.01). The authors' conclusions were that PSI was a viable instructional model to teach higher level mathematics.

Having proven to be an effective teaching method in other academic fields, research on PSI within physical education is limited (Pritchard, Penix, Colquitt, & McCollum, 2012). Implementations of PSI in physical education have been documented in volleyball, golf, racquetball, and tennis (Metzler & Sebolt, 1994), as well as personal fitness (Colquitt, Pritchard, & McCollum, 2011) with the majority of research focused on collegiate activity courses. A few studies have examined this instructional model at the secondary level with success (Hannon, Holt, & Hatten, 2008; Pritchard, Penix, Colquitt, & McCollum, 2012).

The National Association for Physical Education and Sport (NASPE) has stated that the outcome of an effective physical education program is to "develop physically literate individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity" (AAHPERD, 2013). To accomplish

this, research needs to be done that examines different instructional strategies, beyond the traditional lecture-based approach. One instructional strategy that holds potential for meeting both students' needs and national standards is the Personalized System of Instruction (PSI) (Keller, 1968).

Health-Related Fitness Knowledge

Health-related fitness (HRF), or physical fitness, is generally differentiated into five categories: aerobic endurance, muscle strength, muscle endurance, flexibility, and body composition (NASPE, 2011). A growing concern among policy makers and those involved in physical activity is the significant decrease in activity levels of adolescents, particularly among females (USDHHS, 2010). The Centers for Disease Control and Prevention (2011) recommends that adolescents participate in at least 60 minutes of aerobic activity a day, 7 days a week, and at least 3 days of muscle strength activities a week. Potential consequences of being physically inactive include increased risk for obesity (NCCDPHP, 2011), and decreases in cardiovascular health, physical fitness (Eaton et al., 2012), and psychological well-being (Goldfield et al., 2011). With an appropriately designed exercise regimen, fitness levels will increase in most individuals who comply with the regimen.

It has been stated that the dominate venue for HRF development is physical education classes (Morena Muricia, Coll, & Perez, 2009; Pate, Ward, O'Neill, & Dowda, 2007; Sallis et al., 2012), and many have reported successes in increasing PA. Yet many would argue that increasing knowledge is more

beneficial to lifelong fitness (Ennis, 2012; Corbin & Lindsey, 2007). Keating and colleagues (2003) commented that increasing student knowledge leads to increased activity, but not the reverse. Even now, many report varying levels of student ignorance pertaining to HRF knowledge and are not prepared to engage in lifelong fitness (Brynteson & Adams, 1993; Dilorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998). An issue that arises with current practices is that while many different instructional models, such as Sport Education (SE), do incorporate components of HRF into their lessons (Hastie & Trost, 2002), very few spend the time in the instruction of HRF concepts. This, however, still does not constitute student learning (Placek et al., 2001). Thompson and Hannon (2012) report that while subjects were moderately active, their levels of HRF knowledge were extremely lacking.

An approach that has been used recently to promote HRF knowledge is the implementation of conceptually based HRF (CBHRF) courses. These classes generally combine classroom knowledge with a series of labs designed to apply the knowledge learned. Adams II, Graves, and Adams (2006) reported significant increases in HRF knowledge after completion of a CBHRF course compared to those not having completed a CBHRF. Additionally, the authors reported significant differences in HRF knowledge up to 4 years postcompletion, suggesting that this model also aids in knowledge retention. In addition to the CBHRF model, PSI may be another useful strategy to increase students' HRF knowledge by providing a model that combines the acquisition of knowledge with the application of that knowledge.

Statement of the Problem

With the steady decrease in time spent in physical activity and a very small percentage of adolescents meeting guidelines for health-related fitness, traditional delivery of curriculum is not meeting the needs of today's youth. PSI is an instructional model that has shown great success in other fields of academia, and potentially can meet the expressed desires of adolescents: increased autonomy, skills mastery, and relatedness. However, there are only a handful of studies that have examined its use and success in physical education. Most studies have examined the implementation of PSI in individual and team sports, but few have investigated personal fitness as a possible unit of study. Due to this gap in the literature, very little is known regarding PSI in physical education.

Study Purposes

This project will implement a two-study approach that will examine: 1) the fidelity of the Personalized System of Instruction curriculum model as a mode of instruction for an introductory high school personal fitness course, and 2) changes in health-related fitness content knowledge and physical activity levels in a class using PSI compared to another class using a standard DI approach.

Research Questions

This project will seek to answer the following questions:

1. Is the Personalized System of Instruction an effective instructional model to teach students health-related fitness concepts during a high school

personal fitness physical education class?

2. Will the use of PSI increase content knowledge regarding health-related fitness compared to a DI approach?
3. Will students in a class that uses PSI have different levels of classroom physical activity levels compared to students in a DI class?

Key Terms

For the purpose of this study, the following terms are defined:

Instructional model: a comprehensive and coherent plan for teaching that is designed to be used for an entire unit of instruction. It goes beyond the limitations of teaching methods, styles, and skills and provides an effective way to reach aims for learning within great diversity of content. It can be considered as a blueprint for a teacher to follow (Metzler, 2005).

Instructional model benchmark indicators: patterns of teacher and student operations that should happen while a particular instructional model is used. These benchmarks can be used to verify proper planning, instructional operations, as well as being used for model-implementation purposes (Metzler, 2005).

Mastery-based learning: students must meet a performance criterion that represents “mastery” of a given concept or skill. Multiple attempts are allowed along with corrective instruction to aid the student’s progress (Slavin, 1987).

Pacing rate: rate at which students pace themselves on completing criterion tasks from the modified PSI course workbook.

Self-pacing: students move at their own rate and ability level through a step-by-step progression without the teacher acting as a guide (Keller, 1974).

Limitations and Assumptions of the Study

The following limitations are considered for this study:

1. This study is limited to the students from a local high school in the Mountain West region of the United States.
2. A convenience sample was used. Students chosen were from intact classes.
3. Previous experience and knowledge may play a role in outcomes.

The following assumptions are acknowledged:

1. Student and teacher behaviors are assumed to be consistent during the entire study.
2. Participants are assumed to answer and perform tasks to the best of their abilities.
3. Due the concurrent nature of the two studies, it is assumed that the format used falls under PSI.

Significance of Study

There is an alarming decrease in the physical activity levels of adolescents. The greatest venue for increasing their activity and thus increasing their fitness levels is school-based physical education classes. Traditional physical education incorporates a direct, command style instructional model that

decreases students' basic need for autonomy. The current format also encourages game play rather than skill mastery and increased competency. It also hinders students' options to learn and engage in relevant life-long activities that promote health-related fitness.

This study is significant in that it may provide evidence of a specific instructional strategy that can be incorporated into daily physical education. The results may also add to the body of literature regarding basic psychological needs and the influence a supportive instructional model such as PSI can have. This study also has potential impact in teacher training and professional development as a legitimate way to instruct multiple skill levels within the same class.

CHAPTER 2

STUDY 1: FIDELITY OF A PERSONAL FITNESS UNIT USING THE PERSONALIZED SYSTEM OF INSTRUCTION MODEL

Introduction

Regular engagement in physical activity is extremely important in the growth and maturation of adolescents. A growing concern is the significant decrease in activity levels of adolescents. The Center for Disease Control (2011) recommends that adolescents participate in at least 60 minutes of aerobic activity a day,7 days a week, and at least 3 days of muscle strength activities a week. According to Song, Carroll, and Fulton (2013), only 16.3% of adolescents in the United States achieved these recommendation goals and almost half (47.8%) meet neither goal. Others report significant decreases in physical education participation between 8^{th} (91%) and 12^{th} (34%) grades (CDC, 2011). It is well known that potential consequences of being physically inactive include increased risk for obesity (Trost, Kerr, Ward, & Pate, 2001), and decreases in cardiovascular health, physical fitness (Grunbaum et al., 2004), and psychological well-being (Goldfield et al., 2011). If a national goal is helping teenagers lead a healthy life by increasing physical activity, one needs to

examine the reasons why teenagers stop being as active during the adolescent years.

For the majority of adolescents, physical education classes provide the best environment for increasing activity levels and, thereby, personal fitness levels (Morena Muricia, Coll, & Perez, 2009; Pate, Ward, O'Neill, & Dowda, 2007; Sallis et al., 2012). Others have also reported decreases in motivation (Olafson, 2002; Osborne, Bauer, & Sutliff, 2002; Parish & Treasure, 2003; Whitehead & Biddle, 2008) and perceived relevance (Saffici, 1999; Webster, Mindrila, & Weaver, 2011). Trudeau and Shepard (2005) have suggested that decreases in participation in physical education may be due to the formatting or structuring of the class. When students do not perceive that what or how something is taught is important to their lives, there is potential for decreased involvement and decreased activity within the classroom (Webster, Mindrila, & Weaver, 2011). Cothran and Ennis (1999) also reported that when students perceive the curriculum as enjoyable and meaningful, the desire on the behalf of the students to participate increases. The authors go on to say that to meet this desire for relevance, physical educators need to evaluate what is being taught and how it is being taught. The use of other curricular models (model-based instruction) (MBI) as a means to increasing and improving student engagement in physical education is echoed by others (Joyce, Weil, & Calhoun, 2009). The common theme throughout these methods is to increase student knowledge and provide opportunities for physical activity. Metzler (2005) states that utilizing an MBI approach when teaching provides a blueprint from which to formulate a quality

curriculum. MBI provides a multitude of benefits, including: 1) providing an overall plan for teaching, 2) has research support, 3) allows for valid assessments, and 4) promotes specific standards and learning outcomes (Metzler, 2005).

Traditionally, secondary physical education teachers utilize a direct instruction model (DI) to teach traditional team sports, such as flag football, basketball, and soccer (Bauman et al., 2009). While DI can be effective, consistent decreases in student motivation, participation, and health-related fitness (HRF) highlight a need to examine other potential instructional strategies. Curtner- Smith, Todorovich, McCaughtry, and Lacon (2001) have suggested that physical education teachers need to move from the direct, teacher-centered methods of teaching and incorporate more indirect, pupil-centered instructional strategies to help increase motivation and participation within physical education. Indirect instruction generally allows a student to learn at their own pace by providing more opportunities for learning and practice. Increased practice time leads to higher levels of perceived competence, which in turn can lead to higher levels of activity. Student-centered practices can encourage a task or mastery-involved environment, where students are allowed to perform based upon a predetermined set of criteria, rather than an ego-involved environment that concentrates more on the ranking of students based upon performance. The Personalized System of Instruction (PSI) is an instructional model in physical education that has the potential increase physical activity and skill and knowledge simultaneously.

The PSI model was originally designed by Dr. Fred Keller in the early 1960s (Keller, 1968) to replace traditional lecturing and incorporate an independent, self-paced approach to learning. Due to larger class sizes, Dr. Keller had doubts that the traditional, lecture-based curriculum model would work. He, through prior work, had realized that individuals generally learned at their own pace rather than a predetermined rate and that they could learn independently when provided with proper support materials, including written handouts and feedback through an individual who had already mastered the material. This personalization is one of the driving forces for PSI. As described by Keller, by being able to discuss results with another individual, generally a proctor, confusion and misunderstandings were overcome to the betterment of the student.

The “Keller Plan,” as PSI is sometimes referred to, has five distinct characteristics: self-pacing, mastery learning, teacher as motivator, emphasis on the written word, and the use of proctors (Keller, 1968). Self-pacing allows students to work at their own speed, or as Metzler (2000) states, as fast as they want or as slow as they need. The self-pacing of the student is determined by the experience of the student and the external demands of life. Mastery learning means that the student may only progress to the next unit or modular when they have demonstrated mastery of the current subject. This usually takes the form of a written assessment, but can be another form that is approved by the instructor that allows for the student to showcase what they have learned, whether skills or knowledge. The third characteristic is that the teacher acts as a motivator, as

opposed to the sole source of information. Traditionally in education, emphasis was placed upon the teacher's knowledge and the passing of skills and knowledge on to the student. Within PSI, the knowledge that the teacher possesses is incorporated into the lessons and modules, making the emphasis on the written word for materials and learning, usually a workbook. The fifth characteristic is the use of proctors to aid in assessments. Several authors have commented on the importance of proctors to the successful use of PSI in the classroom (Calhoun, 1976; Carlson & Minke, 1976; Farmer, Lacheter, Blaustein, & Cole, 1972). The use of proctors provides several benefits, including allowing students quick or immediate feedback on assessments and providing the opportunity to repeat assessments if needed.

In the 1970s, research on PSI suggested that it would replace or at the least be comparable to traditional lecture in higher education (Taveggia, 1976). During the 1980s, the use of PSI declined, but implementation began to increase during the 1990s. With the current trend of online and Web-based learning in the 21st century, PSI has again shown its viability as a legitimate instructional model within education (Grant & Spencer, 2008). With current technology, instructors are able to post modules online (as opposed to the traditional written workbook). Several online teaching platforms offer testing that provides the student with immediate feedback on some assessments. Online sources, such as YouTube, can be used to demonstrate proper activities compared to still pictures and diagrams previously used. Finally, with readily available access to the Internet

through tablets and phones, instructors have a wealth of resources to aid in their teaching.

Several studies from a wide variety of fields have highlighted the effectiveness of PSI as a legitimate mode of teaching ranging from psychology (Calhoun, 1977; Johnson & Croft, 1975: Springer & Pear, 2008), nurse education (Fell, 1989), distance education (Grant & Spencer, 2003), mathematics (Hambleton, Foster, & Richardson, 1998), and biochemistry (Occorr & Osgood, 2003). Research on PSI within physical education is limited (Pritchard, Penix, Colquitt, & McCollum, 2012). The use of PSI in physical education to teach skills has been documented in volleyball, golf, racquetball, and tennis (Metzler & Sebolt, 1994). Others have demonstrated the use of PSI to teach more health-related content knowledge. Hannon and colleagues (2008) successfully implemented a HRF unit using PSI to teach postrehabilitation fitness in a high school setting. Their 3-week study demonstrated the effectiveness of PSI to successfully teach content knowledge as opposed to the traditionally researched skill acquisition. Pritchard et al. (2012) reported increases in content knowledge as well as fitness levels (cardiovascular endurance, muscle strength and endurance, flexibility) in a collegiate weight training class.

The majority of research on PSI has been for skill development and acquisition primarily at the collegiate level. Metzler and Sebolt (1994) have stated that units utilizing PSI could easily be adapted to middle and high school levels. The major issue, according to Tousignant (1983) is the involvement of the teacher in creating the lesson plans associated with PSI modules. The National

Association for Physical Education and Sport (NASPE) has stated that the outcome of an effective physical education program is to “develop physically literate individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity” (AAHPERD, 2013). To accomplish this, research needs to be done that examines different instructional strategies, beyond the traditional lecture-based approach.

An issue that arises with implementing theoretical strategies into daily practices is the concept of fidelity. O’Connell (2008) states that fidelity of implementation determines how well the intervention compares to the original design. Without examining fidelity, gaps arise that can significantly alter intended outcomes within the study (Hulleman & Cordray, 2009). As with other research, the usage of a different convention of teaching must be examined to make sure that what is being taught and how it is being taught matches the theory. With myriad instruction strategies, it can be difficult to use one particular instrument to determine fidelity. As previously mentioned, PSI has been incorporated and determined successful in a variety of educational areas, including physical education. However, only a handful have actually examined the fidelity of implementation of PSI (Cregger & Metzler, 1992; Hannon, Holt, & Hatten, 2008) while others have utilized benchmarks to maintain fidelity (Colquitt, Pritchard, & McCollum, 2011; Pritchard, Penix, Colquitt, & McCollum, 2012). With the potential for PSI to be a highly effective instructional strategy for secondary physical education, the purpose of this study was to examine the fidelity of implementing a personal fitness unit utilizing the PSI model at the high school

level. Fidelity studies examining the implementation of PSI generally look at the four main characteristics of PSI: self-mastery, self-pacing, teacher as motivator, and emphasis on written material for teaching (Keller & Sherman, 1974) as well as the 12 design features (Hannon, Holt, & Hatten, 2008):

- Independent Study Progression
- Low Management time
- High Rate of Cues and Guidance
- High Rate of Task Related Feedback
- Performance of Tasks to Criterion
- Student Rating of PSI for Learning
- High Rate of Practice Time
- High Rate of Attendance
- Learning Tasks in Written Form
- Study Materials in Written Form
- Class Information in Written Form
- Low Lecture/Demonstration Time

The fifth characteristic, the use of proctors, was not included in this study due to the lack of available proctors. Previously, it was stated that the use of proctors is a key element to the successful implementation of PSI. Depending on the environment of the class, particularly in secondary education, the use of proctors may in fact cause more problems than solutions (Caldwell, 1985). Others have reported similar instances of student learning outcomes not being met due to the subjective assessments that were used (Caldwell et al., 1978). Robin and Cook (1978) comment about the effort needed to properly train proctors, therefore making the use of proctors potentially counterproductive. Using the 12 design features reported by Cregger and Metzler (1992), it was hypothesized that at least 9 (75%) of the features would meet the predetermined criteria.

Methodology

Participants

One physical education class of 25 students (*n*=21 males) from a local high school in the urban area of a large city in the Mountain West region of the U.S. were recruited for this study. This school and teacher were approached based upon prior relationships and willingness to examine different instructional strategies within physical education. Approval from the school and University Institutional Review Board was obtained and parental permission and child assent were granted prior to the beginning of the study. An introductory section of personal fitness was selected based upon the need for proper training of high school students in resistance training, health related fitness, and the application of this information.

The class met for 6 weeks, 4 days a week for 40 minutes of weight room activities. Available resources included a moderately sized fitness facility consisting of free weights, dumbbells, weight machines, and cardiovascular equipment. The classroom teacher had a degree in pedagogy with 16 years of teaching experience with knowledge of the format of PSI. The Principal Investigator (PI) trained the teacher in PSI philosophy and implementation as well as worked closely to maintain fidelity of the instructional strategy and curriculum.

Curriculum

The curriculum used for this study was adapted from Colquitt, Pritchard, and McCollum's (2011) personal fitness unit originally developed for secondary and collegiate students. Topics covered included cardiovascular fitness, muscle strength and endurance, flexibility, body composition, and nutrition. Students were required to demonstrate competencies and content knowledge through written assignments, task performance and completion, and creation of exercise workouts based upon fitness improvement areas.

Materials

The workbook (Appendix E) was designed to introduce the student to personal fitness through the PSI model: explaining how the curriculum (modules) work, as well as learning objectives, classroom policies, readings and access to learning videos demonstrating specific exercise techniques. Students had the opportunity to complete 16 modules during the 6-week study. This program was designed to be used by students at the beginning of the physical education course as an introduction to health and fitness, with the outcome being the ability of the student to self-evaluate their current fitness levels and, based upon these results, create an individual workout that will assist them in reaching their fitness goals. The curriculum used provided an overview of fitness, proper lifting techniques, how to lift safely, and content designed to encourage a healthy lifestyle. The curriculum modules consisted of the following:

- Fitness Assessment
- Cardiovascular Training

- Resistance Training
- Flexibility Training
- Fitness Principles
- Program Design
- Nutrition
- Fluid Balance
- Abdominals & Lower Back
- Hip/Thigh Multi-joint
- Hip/Thigh Single-joint
- Chest
- Upper Back
- Shoulders
- Biceps
- Triceps

Instrumentation

Utilizing Cregger and Metzler's original design (1992), 12 data sources were collected for analysis. These sources were categorized into four parts: 1) course management; 2) instructor and student in-class processes; 3) progress of students; and 4) student ratings of PSI features. Criteria were established based upon similar work in PSI and what a "true" PSI model should look like (Table 2.1). These criteria have been established as the gold standard of measuring PSI fidelity and have been used in other fidelity studies (Hannon, Holt, & Hatten, 2008; Leach, 2011).

Procedures

Prior to the beginning of the study, students were instructed on the use of the workbooks and other electronic devices (DVDs, laptop, online videos). Students were reminded that this unit was self-paced, but they could work with others to complete their modules. This provided the opportunity for spotting of lifts as well as partners to check off learning tasks. Based upon PSI's

Table 2.1 Definitions of PSI Confirmation Criteria Data

Characteristic	**Definition**
Step 1. Self-Pacing	
a. Independent Study Progression	Mean percent of tasks completed by students each day
b. Low Management Time	Percent of class time that provided content-related information and spent in management
c. High Rate of Cues & Guidance	Rate per minute the teacher provided verbal guidance and cues
d. High Rate of Task-Related Feedback	Rate per minute of verbal feedback provided during each class
2. Mastery-Based Learning	
a. Performance of Each Task to Criterion	Percent of tasks (assignments) completed to criterion by all students in the class
b. Student Rating of PSI for Learning	Students' perceived increases in skill and knowledge
3. Teacher as Motivator	
a. High Rate of Practice	Percent of class time students spent in subject related practice
b. High Rate of Attendance	Daily average of students' attendance in class
4. Emphasis Placed on Written Word	
a. Learning Task in Written Form	Tasks provided in written form in a workbook
b. Study Materials in Written Form	Study materials provided in written form in a workbook
c. Class Operating Information Written	Class operating policies and procedures provided in written form in a workbook
d. Low Lecture/Demo Time	Percent of class time students spent in lecture/demonstration

characteristic of mastery learning, students were instructed that they needed to complete the first module, “Fitness Assessment,” before they could move on to another module. Criteria for completion of this module included achieving a minimum score of 80% on the assessment quiz, as well as the completion of tasks within the module. Upon mastering the module, students would be allowed to choose the next type of module (i.e., fitness skills or concepts; see Colquitt et al., 2011) they wanted to work on. Students were instructed that to move from one module to the next, they needed to complete the tasks assigned in the module and score an 80% or higher on the assessment quiz at the end of the module. The 6-week time frame allowed ample time for the completion of a majority of modules. As students completed all of the modules at mastery level, they were “recruited” to assist the teaching in checking off performance tasks. Students were encouraged to complete all of the modules during the unit, but were reminded that they must complete and pass one module before moving on to the next. During the 6-week study, students and the classroom teacher were encouraged to make comments regarding the learning and teaching process.

Data Analysis

Data were collected and evaluated based upon the four major components of the PSI instructional strategy (Keller, 1968). A variety of sources were used, including video and audio recordings, student workbooks, and teacher log. Other resources included a single Likert question as well as two questions asked at the conclusion of the study: 1) “Did you feel that you learned

from this type of instruction?" and "What were your thoughts regarding the way this class was taught?" Teacher thoughts and comments were obtained through periodic debriefing between the classroom teacher and the PI. At the conclusion of the study, the teacher was asked to complete a series of open-ended questions including:

1. Compared to other methods of teaching, what is your opinion of the PSI model?
2. How was it different?
3. What were the strengths of the model?
4. What were the weaknesses?
5. What was your sense of student engagement regarding PSI?
6. How would this work in a non-weight-training class?
7. How effective do you think this teaching model was in providing students with content knowledge while still giving them sufficient physical activity?
8. Would you use this model in the future?

Responses were used to probe for deeper investigation of the teacher's thoughts regarding PSI.

Analysis of the program followed procedures established by Cregger and Metzler (1992) that examined four of the five characteristics of PSI: 1) self-pacing; 2) mastery-based learning; 3) teacher as motivator; and 4) emphasis placed on written word. As mentioned previously, this study did not address the fifth characteristic of PSI, referring to the use of proctors during the class. Due to school scheduling, two out of four classes per week were videotaped with the teacher wearing a cordless microphone for later analysis. Video and audio were coded and analyzed by the PI and a second, trained observer. Table 2.1 explains

the criteria data. Individual student progress (1a) was determined by calculating the total number of tasks completed by the class during the study and divided by the number of days within the study. Performance of each task was evaluated similarly by calculating the number of tasks completed by the total number of tasks possible. Five of the criteria (1b, 1c, 1d, 3a, & 4d) were evaluated by coding of video and audio recordings. Rates of cues and feedback were analyzed by determining the number of occurrences during the recorded classes and divided by the total class time. The remaining three (1d, 3a, & 4d) were determined by recording the time spent in each and then dividing by total class time. Student rating of PSI was analyzed through a 5-point Likert scale given at the end of the study. Average daily attendance was determined by subtracting total absences from total opportunities and divided by total, then multiplied by 100 to reach a percentage: (Total – Absences)/Total. The remaining criteria (4a-c) were check offs from the workbook to determine that they were available to the students via written work.

Results

The primary results from the fidelity study are presented in Table 2.2. Three out of the four design characteristics for effective implementation of PSI were met. Results from the first characteristic, self-pacing, showed a 50% success. Independent progression exceeded the minimum standard (≥ 2% per day), signifying that students completed 7.7%, or 1.5 tasks, per day. The second feature, low management time, was considered a success with less than 2% of

Table 2.2 Verification of PSI Implementation

Characteristic	**Study Result**	**Average Result per Class** (38 min)	**Confirmation Criteria**	**Criteria Met**
1. Self-Pacing				
Independent Study Progression	7.7% completed	1.5 tasks	≥2.0% each day	Yes
Low Management Time	1.9% of class time	0.75 min	≤5.0% of class time	Yes
High Rate of Cues & Guidance	0.54 per minute	NA	1 per minute	No
High Rate of Task-Related Feedback	0.68 per minute	NA	1 per minute	No
2. Mastery-Based Learning				
Performance of Each Task to Criterion	83.2% completed	399 out of 480	≥70% completed	Yes
Student Rating of PSI for Learning	4.02 out of 5	NA	3 or higher	Yes
3. Teacher as Motivator				
High Rate of Practice	97.7% of class time	37.13 min	≥75% of class time	Yes
High Rate of Attendance	98% Attendance	0.5 absence per day	≥80% attendance	Yes
4. Emphasis Placed on Written Word				
Learning Task in Written Form	Tasks Provided	NA	Provided	Yes
Study Materials in Written Form	Provided	NA	Provided	Yes
Class Operating Information Written	Policy Provided	NA	Provided	Yes
Low Lecture/Demo Time	2.3% of class time	1 min	≤10% of class time	Yes

the class time used for general management of the class. Both cues and task related feedback did not meet the criteria for confirmation, instead only reporting 0.54 cues per minute of individual guidance and 0.68 occurrences task feedback. The second characteristic of mastery-based learning achieved 100% confirmation. Both design features, achievement of criterion and the student rate of learning through PSI, exceeded the minimum criteria. The third characteristic, teacher as motivator, also reported 100% confirmation. The design feature of high practice time reported that 97.7% (~37 minutes) of class time was available for student practice. Attendance was also high, exceeding the minimum of 80%. The last characteristic investigated, emphasis on the written word, was deemed a success as four out of four design features met the minimum standard. With the majority of information available to the students via their workbooks, little time was needed by the classroom teacher to lecture or demonstrate the skill or activity.

Teacher Observations and Thoughts

Through interviews and open-ended questions, the teacher noted that the first several classes were difficult due to explanation of how PSI worked. “I had to adapt to it at first. Once I did it was great.” When asked how he adapted, the teacher commented that he was used to a lot of demonstrations and time spent explaining. The concept of students being responsible for their work and he was a facilitator required some adjustment. “They are doing the learning and examples themselves. I am only their Sherpa on the climb.” As the study

progressed, less time was spent in managing the students and more time was devoted to providing verbal feedback. He was able to move around more and answer questions or give feedback with students as they were working than previous classes. When asked his impression of student engagement with PSI compared to other methods, the teacher stated that it worked very well with the students. “A couple of the students needed a bit more urging and direction, but it was relatively easy to see who was not getting it.”

The teacher reported that he felt the implementation of the PSI model would work better in the future now that he was more familiar with it. Compared to other instructional styles, he commented that he “liked how the skills and knowledge were incorporated into the same lesson/module. Other instructional approaches separate the two and the students have a difficult time joining them together.” Overall, the teacher was very satisfied in how PSI worked in the classroom. “I love the fact that it’s a lot of work upfront but then the application is easy. Students are able to have an individualized approach. Each kid is in charge of their own education. Most of all I am freed up to help students that need it and students that get it are on to the next thing.” The only weakness reported by the teacher was the starting of the study. “I was not sure how to start and get things going. Once I started it was really easy.”

Students’ Thoughts and Comments

According to the teacher, students were hesitant about the new instructional strategy. One student commented “I enjoyed learning more about

personal fitness, but it seems like we don't get to do anything." This theme of decreased physical activity was common among the students. Some mentioned that they just wanted to lift weights and didn't care about gaining the content knowledge. As the study progressed students were able to incorporate the knowledge and the skills into their activity. One female student said "I like that I know what and why I am doing when working out. This will definitely help me later." Overall, the majority of students reported that they enjoyed being able to learn a little more about what they were doing rather than just lifting.

Discussion

The primary aim of this study was to examine the effectiveness of implementing a personal fitness unit using the PSI model. Determining the successful implementation of the PSI model, according to Cregger and Metzler (1992), requires meeting 70% of the 12 design features outlined in Table 2.1. It was hypothesized for this study that at least 9 out of the 12 (75%) features would be successfully met. Results from the study showed that 10 out of the 12 (83%) design features met the confirmation criteria. This suggests that the implementation of the curriculum followed standards of PSI. In addition, comments from the teacher and students were positive towards the use of PSI in teaching a personal fitness unit for high school students.

An important finding from this study was the use of cues and guidance and task related feedback. Cregger and Metzler (1992) originally suggested that 1 incident per minute was a criterion for success for each feature. In this study,

we reported 0.54 cues per minute and 0.68 occurrences of feedback per minute. One potential reason for failing to meet the predetermined one occurrence per minute criterion was the lack of proctors. Keller's original PSI work commented on the use of proctors in assisting the module assessments. This could alleviate time that could be spent providing feedback and cues. The use of proctors with PSI is mixed. Some report decreases in overall learning when proctors are used (Caldwell, 1978) while others state that their use is central to using PSI (Calhoun, 1976; Farmer, Lachter, Blaustein, & Cole, 1972). Other studies involving PSI in high school PE have not utilized proctors because of the difficulty in proper training (Hannon, Holt, & Hatten, 2008). In this study, traditional proctors were not used, but investigation into the impact of proctors in high school classes using PSI needs to be addressed.

Other key findings from this study included the levels of management time and lecture/demonstration time (1.9% and 2.3% of class time, respectively), thus increasing time spent in practice (97.7% of class time). Increases in practice time have multiple effects on outcomes of physical education. First, increased practice time allows for development of motor skills and competencies that help to meet national standards (AAHPERD, 2013). These developed skills can manifest themselves in increases in health-related fitness components later in life (Stodden, Langendorfer, & Roberston, 2009). Secondly, increases in competencies can play a vital role in moving towards more intrinsic motivation towards physical activity (Clark, 2007; Standage & Ryan, 2012; Stodden et al., 2009). A potential drawback of other types of instructional models is the

decrease in time for practice, whereas this study demonstrates the possibility PSI has in increasing practice time, leading to potential higher levels of competency.

One of the major barriers in implementing a new instructional strategy is the buy-in from the classroom teacher. Most successful teaching models require a lot of planning on the teacher's behalf. This is true of PSI as well. With the creation of the modules, including what skills to teach, how to assess those skills, and any other pertinent information, the whole process can be daunting. The classroom teacher in this study acknowledged this, but went on to say that it is worth it because of what PSI does for the student learning experience. Other areas that could appeal to practitioners is the ability of the teacher to engage with more students, providing feedback and cues, and encouraging the students in the tasks they are working on.

Although the majority of the results from this study were positive, care must be taken to insure that generalizations are not made towards other activities in physical education. This study examined the use of the PSI model in a personal fitness unit. Other types of content, including individual sports and team sports, need to be investigated separately for the possible usage of PSI.

There were a few limitations to the study. First, the study took place during the second semester of the school year. While many students were new, a returning cadre of experienced students may have altered the outcome. Another limitation could be the lack of experience in PSI on behalf of the classroom teacher. Although the classroom teacher was familiar with PSI and the Primary Investigator (PI) provided extra training and feedback, not having a solid base for

this instructional strategy might have prevented the teacher from engaging in more feedback and verbal guidance. While gender was not considered during this study, the majority of males (83.3%) within the study might have affected the outcome.

This study used the traditional approach of a pencil and paper workbook and DVD videos for demonstrating technique. With the availability of a plethora of technology, studies need to be conducted utilizing these avenues with PSI. Instead of a pencil and paper workbook, the information could be presented using a tablet or other handheld devices. Quizzes can be taken and corrected using various online teaching platforms as well as the showing of demonstration videos. The implementation of these technologies could potentially free up the classroom teacher, allowing them to interact more with students as the original model was intended. More study needs to be conducted to further investigate other variables associated with teaching styles and curriculum, including content knowledge, physical activity levels, and psychosocial variables.

Conclusion

The results from this study showed that a personal fitness unit using the PSI teaching model was successfully implemented. It adds to the minimal literature available investigating PSI's use in high school physical education. More research must be done to examine the effect of this instructional strategy in the context of general physical education classes.

CHAPTER 3

STUDY 2: EFFECT OF PERSONALIZED SYSTEM OF INSTRUCTION ON HEALTH-RELATED FITNESS KNOWLEDGE AND CLASSTIME PHYSICAL ACTIVITY

Introduction

According to the Centers for Disease Control (CDC) (2011), participation in physical education is decreasing significantly during the secondary school years. Song, Carroll, and Fulton (2013) have reported that only 16.3% of teenagers in the United States meet the CDC's recommended levels for physical activity. As physical activity levels decrease so do levels of health-related fitness (HRF) (United States Department of Health and Human Services, 2010), which in turn lead to decreases in an individual's health (Eaton et al., 2012; Goldfield et al., 2011; National Center for Chronic Disease Prevention and Health Promotion, 2011). For adolescents, the natural venue for increasing physical activity and improving HRF is in physical education classes (Moreno Muricia, Coll, & Perez, 2009; Pate, Ward, O'Neill, & Dowda, 2007; Sallis et al., 2012). While this is good practice, being physically active is only one goal of a quality physical education program (AAHPERD, 2013). By focusing solely on psychomotor outcomes,

physical educators overlook the acquisition of the content knowledge related to health-related fitness (HRF), physical activity, and overall health.

Slingerland and Borghouts (2011) have stated that physical education can have direct and indirect influences on fitness levels of children and adolescents by engaging in physical activity within class and instructing HRF to understand the benefits of PA outside of class. Yet traditionally, there has been a lack of priority towards increasing the cognitive aspect of physical education (Stewart & Mitchell, 2003), with several authors commenting on the lack of HRF knowledge and preparedness to engage in lifelong fitness in today's youth (Brynteson & Adams, 1993; Dilorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998). As knowledge increases, adolescents possess a better understanding of a healthy life and what it takes to engage in physical activity (Keating et al., 2003). Ennis (2012) has suggested that these increases in knowledge can off-set negative beliefs about fitness and combat the decline in PA within physical education classes. Others would assert that increased knowledge is actually more beneficial to lifelong fitness than increased in-class physical activity (Corbin & Lindsey, 2007). To assist students in becoming more active during physical education class, teachers need to be able and willing to provide quality instruction with appropriate instructional strategies (Bryan & Solomon, 2012) that address HRF knowledge and physical activity.

There are currently eight common instructional models that have been shown to be effective in teaching physical education, including direct instruction (DI) and the personalized system for instruction (PSI) (Metzler, 2005). DI is a

teacher-centered approach where the instructor determines the majority of the content of the lesson and class, and how much a student is involved in participation (Mendez, Valero, & Casey, 2010). It is suggested that DI is an appropriate strategy to use when basic skill development and safety issues are of highest importance or when working with younger students in skill development (Ayers et al., 2005; Sweeting & Rink, 1999). The DI model requires the teacher to have a high level of expertise and to have control over the progression of the lesson, including assessment, practice time, and tasks. As noted, this approach works well with skill development, yet has not proven to be as effective in developing HRF knowledge. Opponents of DI have stated that when using this strategy, creativity and the ability to problem solve decreases (Peterson, 1979). If an outcome of a quality physical education program is to have students be able to apply what they have learned in class (AAHPERD, 2013), they must be able to do more than restate concepts they have learned (Castelli & Williams, 2007).

Another instructional model is PSI. It was originally designed by Dr. Fred Keller in the early 1960s to replace traditional lecturing and incorporate an independent, mastery learning approach to learning (Keller, 1968). The “Keller Plan,” as PSI is sometimes referred to, has five distinct characteristics: self-pacing, mastery learning, emphasis on the written word for learning, teacher as motivator, and the use of proctors (Keller, 1968). Since the mid-1960s, the PSI has been used throughout the educational domain with tremendous success (Bangert, Kulick, & Kulick, 1983; Calhoun, 1977; Fell, 1989; Grant & Spencer, 2003; Johnson & Croft, 1975; Kulick, Kulick, & Cohen, 1979; Springer & Pear,

2008) including physical education. Successful use of PSI in physical education has been documented in volleyball, golf, racquetball, and tennis (Metzler & Sebolt, 1994), as well as personal fitness (Colquitt, Pritchard, & McCollum, 2011). Hannon, Holt, and Hatten (2008) used this instructional model to teach HRF content knowledge in a high school weight training class. Pritchard and colleagues (2012) used PSI to teach a weight training class. Their results showed students significantly increased their HRF knowledge and fitness levels (curl-ups, push-ups, and body composition). These results suggest that PSI not only increases student content knowledge, but also provides the physical activity needed to increase fitness levels. While few studies have researched PSI at the high school level, this strategy shows potential to be an effective mode of instruction to improve student HRF content knowledge.

The PSI presents a unique approach to increasing HRF content knowledge. Previous research has suggested the use of PSI increases student learning, and allows for more physical activity by increasing practice time and decreasing teacher management time (Cregger, 1994; Metzler, 1986;). However, there is little research examining the effectiveness of PSI during a high school personal fitness class. Therefore, the primary purpose of this study was to investigate changes in HRF knowledge between one personal fitness class using the PSI strategy and a class that uses a DI model control. It is hypothesized that students in the PSI class will have significantly higher HRF knowledge gains after a 6-week study than students in the DI class. The second purpose of this research was to explore differences in physical activity between the two classes.

It is hypothesized that there will be no significant difference in physical activity levels between the PSI class and the DI class.

Methodology

Participants

Two physical education classes from a local private high school in the urban area of a large city in the Mountain West region of the U.S. were recruited for this study. One class (n=24, m_{age}=15.4 ± 1.23 years old) implemented a personal fitness unit using the PSI strategy while the second (n=29, m_{age}=15.31 ± 1.17 years old) used a traditional DI approach to teach personal fitness. Approval from the school and University Institutional Review Board was obtained and parental permission and child assent were granted prior to the beginning of the study.

Scheduling of the school allowed classes to meet in the school's weight room 4 days a week for 40 minutes. Available resources included a moderately sized fitness facility consisting of free weights, dumbbells, weight machines, and cardiovascular equipment. The classroom teacher (16 years of experience) had a familiarity with both instructional strategies. The Principal Investigator (PI) provided additional training for the teacher in PSI philosophy and implementation.

Instrumentation

HRF Content Knowledge

A 45-question assessment (Appendix D) pertaining to weight training and fitness was used to measure students' personal fitness content knowledge (Pritchard, Penix, Colquitt, & McCollum, 2012). Based upon McGee and Farrow's test bank (1987) for physical education activities, the assessment utilizes case studies, multiple-choice, and true/false questions that examine cardiorespiratory endurance, muscle strength and endurance, flexibility, body composition, and nutrition. Each question was awarded one point. Assessment examples included:

- What is a function of fat?
- Which activity is the best example of aerobic exercise?
- Which is *not* a factor influencing flexibility?
- Which is the best example of measuring intensity for cardiorespiratory training?

The assessment and curriculum were evaluated by a Certified Strength and Conditioning Specialist from the National Strength and Conditioning Association as well as a high school physical education teacher with over 12 years of teaching weight training classes to establish content validity.

Physical Activity

Both classes were observed for levels of physical activity by using a modification of the System for Observing Fitness Instructional Time (SOFIT) (McKenzie, Sallis, & Nader, 1991) during class time to assess overall physical

activity (PA) levels as well as time spent in moderate to vigorous intensity (MVI) activity. This systematic observation uses a 5-point scale to measure student PA: 1) lying down; 2) sitting; 3) standing; 4) walking; and 5) vigorous (activity requiring more effort than walking). SOFIT utilizes a time interval of 10 seconds observation followed by 10 seconds of recording. Five students were observed based upon McKenzie's (2012) protocol of entering the room. The first participant was observed for 12 intervals (4 minutes) before moving to the second, then the third, etc. Students were observed for the entire class period (~32 minutes). Twelve classes (six for each group) were observed during the 6-week study.

As there are no observation tools that have been used for resistance training, modifications were made to the original SOFIT scale. The first two scores were kept while "spotting" was grouped with three. For the remaining two levels, Ainsworth's compendium (1993) was consulted with MET values for walking (3.0) compared to values for light to moderate resistance training (3.0). Examples included bicep curls, abdominal exercises, and body weight activities. Vigorous effort was classified as activity requiring more effort than light to moderate effort (>3.0 METS). Interrater reliability protocol established by McKenzie (2012) was followed with a result of 86.3%, exceeding the pre-established mark of 80% reliability.

Protocol

One week prior to the start of the study, students in both groups completed the fitness concepts assessment to establish baseline knowledge.

Participants were instructed to answer the questions to the best of their abilities. Upon completion of the 6-week study, participants completed the assessment to determine potential changes in knowledge. Students were again asked to complete the knowledge assessment 3 weeks poststudy to examine retention of learning.

PSI Class: During the 6-week study, Group 1 followed a curriculum adapted from Colquitt, Pritchard, and McCollum (2011) for personal fitness using the PSI model. The curriculum consists of 16 modules designed to teach HRF and introductory resistance training. A characteristic of PSI is the ability of the student to progress through the curriculum at their own pace and it allows them to choose which content or exercise skill modules they want to work on. Periodic reviews of the classes were conducted to provide necessary feedback to the classroom teacher to insure fidelity of PSI (Tables 3.1 & 3.2). These reviews consisted of observation of student and teacher activity, and student workbooks. If benchmarks were not being met, the PI would notify the classroom teacher and suggest strategies to meet standards.

DI Class: For the DI group, class content matched those used by the PSI group. Progression, evaluation, and time spent on each topic were determined by the classroom teacher. Instruction, including demonstrations of lift techniques, was given to the class as a whole. Daily workouts were written on the board and explained to the students. The class was divided into three groups to prevent backlogs on equipment.

Table 3.1. Teacher Fidelity Benchmarks for Personalized System of Instruction

Benchmarks	**How to Verify**
Teacher ensures PSI course materials are clear to students	Monitor the number and types of questions students ask after reading/viewing information in their workbooks
Teacher has very low percentage of managerial time in class (< 2%)	Use a stopwatch to measure how much management time teacher uses in class
Teacher has very high rates of individualized instructional interactions in class	Audiotape a lesson and count the number of cues, feedbacks, and questions directed to individual students
Teacher sets performance criteria for tasks at appropriate levels of difficulty	Direct students to practice tasks in blocks (e.g., 10 trials) and to record the number of successful tasks in each block. If most students reach mastery after one or two blocks, the task is too easy. If many students get "stuck" on a task, it is too difficult. Adjust the task or performance criteria accordingly
Teacher does not spend too much time witnessing and verifying mastery attempts	Count the number of times the teacher witnessed mastery attempts in each class. If that takes away from instruction time: (1) design more self- and partner-checked tasks, or (2) appoint some dependable students as temporary witnesses until the backlog is gone
Teacher makes few or no task presentations	Count the number of task presentations made in class. If those presentations take away from instructional time with individual students, design and produce media-based task presentations

Table 3.2. Student Fidelity Benchmarks for Personalized System of Instruction

Benchmarks	**How to Verify**
Students have understood written or visual task presentation	1. Check for understanding 2. Monitor students on comprehension tasks that demonstrate key elements from the task presentation 3. Note the number and pattern of students' questions
Students are staying on-task	Periodically monitor and count the number of students who are on-task in class
Students can properly set up learning activities from the written task structure information	Observe several students setting up learning stations. Noted how long it takes each one to set up and how correctly it is done
Students do not make "inappropriate progress" (i.e., cheat on verifying mastery)	Review students' progress chart each day, looking for faster than expected progression
Student progression is more or less even	Review personal progress charts often

Both classes covered the following knowledge and skills: fitness assessment, cardiovascular, resistance, and flexibility training, fitness principles, program design, nutrition and fluid balance, and lifts for chest, legs, back, arms, and abdominals.

Data Analysis

This study used a quasi-experimental, nonequivalent design (Campbell & Stanely, 1963) due to using preestablished classes. Data were analyzed using SPSS 20 (SPSS, Inc., Chicago, IL) and checked for missing values, outliers, and

normality. Missing data were excluded pairwise during analysis. Statistical significance was set at the 0.05 level for all analyses. Scores from HRF were analyzed via a 2 (group) by 3 (time) analysis of variance (ANOVA) while class PA differences were analyzed with *t*-tests. Means and standard deviations of descriptive statistics are included in Table 3.3.

Results

HRF Content Knowledge

Pretest scores from the HRF were analyzed to determine significant differences prior to the beginning of the study (Campbell & Stanley, 1963). Pretest results showed that no significant differences were observed between groups at pretest (*F[1, 52]=0.420*, *p*=0.52). Results showed that there was a significant increase in test scores (*F*[(1, 24]=6.78, *p*=0.003) in the PSI group from

Table 3.3

Descriptive Statistics

Dependent Variable	PSI (*n*=24)	Control (*n*=29)
Age (years)	15.40 ± 1.23	15.31 ± 1.14
Pretest Scores	13.72 ± 3.89	12.90 ± 5.23
Posttest Scores	17.60 ± 6.59	14.14 ± 4.68
Follow-up Scores	15.16 ± 5.89	13.00 ± 3.94
% Time Spent in MVI	21%	20.3%

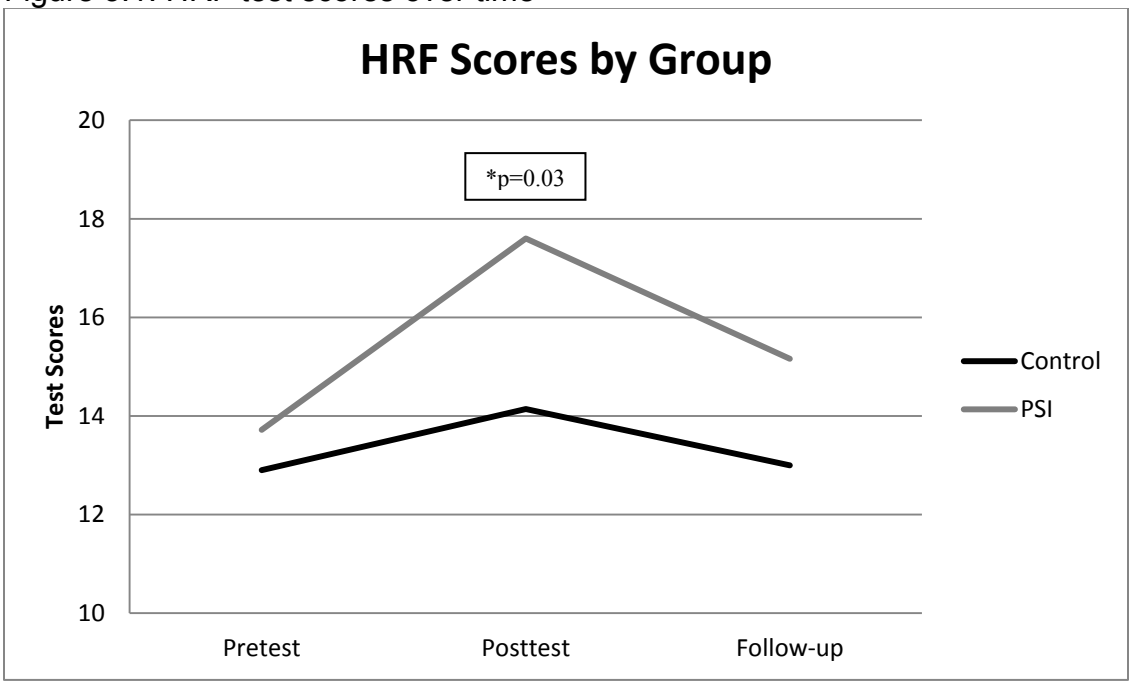
Mean ± Standard Deviation

pretest (*m*=13.72, *SD*=3.89) to posttest (*m*=17.6, *SD*=6.59). Significant differences in posttest HRF knowledge scores (*F*[1, 52]=5.05, *p*=0.03) were also observed between the PSI group (*m*=17.6, *SD*=6.59) and the control group (*m*=14.14, *SD*=4.68). Figure 3.1 shows knowledge scores over time.

Physical Activity Levels

Results from the modified SOFIT observation tool were analyzed to investigate if there were any significant differences between the two groups in time spent in MVI. A paired samples *t*-test showed no significant differences (*t*=-0.27, *p*=0.79) between the PSI group (21% of time spent in MVI) and the control group (20.3% of time spent in MVI) during the 6-week study.

Figure 3.1. HRF test scores over time



Discussion

It is reported that physical activity decreases during the later adolescent years and that students generally lack basic HRF knowledge (Placek et al., 2001; Stewart & Mitchell, 2003). Previous research has stressed the importance of HRF knowledge in the maintaining of physical activity and healthy lifestyles throughout adulthood (Corbin & Lindsey, 2007; Ennis, 2012; Keating et al., 2009; Slingerland & Borghouts, 2011). To overcome this trend, physical education practitioners need to address the content of what they are teaching and the strategies they are incorporating to teach it. Successful incorporation of both content knowledge and skills has been demonstrated to improve HRF knowledge and retention (Adams II, Graves, & Adams, 2006). An effective model in to develop skills in physical education (Colquitt, Pritchard, & McCollum, 2011; Cregger, 1994; Cregger & Metzler, 1992; Pritchard, Peniz, Colquitt, & McCollum, 2012), PSI is an instructional strategy that can be implemented to teach HRF in secondary education (Hannon, Holt, & Hatten, 2008; Pritchard, Penix, Colquitt, & McCollum, 2012). Unfortunately, there is little research on PSI used to teach personal fitness in the high school setting. Therefore, the purpose of this study was to examine changes in HRF content knowledge and physical activity between a class using PSI and a class using DI.

Participants within the PSI class demonstrated significant increases in HRF content knowledge compared to their counterparts in the control class over the course of the study (Figure 3.1). While the results showed a significant increase in HRF knowledge in the PSI class compared to the DI class, overall

scores revealed both classes did not elicit passing grades (PSI=37.7% and DI=31.1%), even with the curriculum designed specifically for personal fitness and HRF knowledge. Previous research supports the results from this study, suggesting that many students lack HRF knowledge (Brusseau, Kulinna, & Cothran, 2011; Kulinna, 2004; Placek et al., 2001; Stewart & Mitchell, 2003; Thompson & Hannon, 2012). More effort needs to be made to provide opportunities for HRF content learning at all age levels.

A traditional argument against classes that concentrate on HRF is the notion that they do not provide enough physical activity compared to other classes, yet there has been little research in this area (Thompson & Hannon, 2012). This study showed that there were no significant differences in class time physical activity between the two groups, suggesting that using PSI in this setting can not only increase HRF knowledge, but maintain physical activity negating the argument that HRF knowledge classes decrease class time physical activity. With the national push to increase school aged students' physical activity (Let's Move! Active Schools, 2014; National Board for Professional Teaching Standards, 2014), showing students how to be active is not enough. Educators and researchers need to be able to show students why and how to be physically activity.

Two characteristics of PSI make it a unique strategy in education. First is the component of mastery learning. Students were required to complete assessments as they progressed through the modules. Each module required the student to score 80% or higher on its quiz and to achieve 100% on individual

assignments. If they did not reach these benchmarks, they were permitted to retake the quiz or recomplete the task until they demonstrated mastery of the subject. This emphasis on mastering the skills and content has shown to improve feelings towards the topic and increase retention of the knowledge learned (Guskey & Gates, 1986; Kulik, Kulik, & Bangert-Downs, 1990).

The second unique characteristic of PSI is self-pacing. Metzler (2005, p. 221) states that when using the PSI model, students can progress “as fast as they want, or as slow as they need.” Students that have experience or a background in the content are able to move at a quicker rate than those who are unfamiliar and need more time to learn and practice. This approach, along with increased practice times, couples with mastery learning to ensure that students are confident and able to perform skills or retain content knowledge. The traditional DI approach states that the teacher determines the pacing of the course, thereby not allowing all students the opportunity to fully learn. With an increase in perceived competence through increased practice and feedback, students are more inclined to engage and participate in physical education classes.

Although the results from this study were positive, care should be taken to make sure that generalizations are not overtly made towards other curriculum. While effective in teaching skills in other activities, this study only examined HRF content knowledge compared to a non-PSI class. It is suggested that more PSI research be conducted to examine differences between PSI and other models in all areas of physical education.

There were a few limitations in this study. First, a relatively small sample size was used for this study. As a private school, class sizes were generally under 28 students per class. A second limitation may be the lack of randomization. The classes recruited were used intact to maintain continuity for student schedules. Finally, there were few females in this study (*n*=7).

As mentioned previously, this study only examined changes in knowledge within a smaller school. It is encouraged that future research not only examine the use of PSI in personal fitness classes at various sized schools, but also in a variety of physical education content, such as individual sports. Another suggestion for research would be to examine the use of technology (Computer-Assisted Instruction) incorporated into PSI teaching.

Conclusion

The results from this study suggest that the PSI model could be an effective way to increase HRF knowledge with high school students while not decreasing their physical activity levels within the class time. This study lines up with the literature demonstrating a lack of HRF knowledge suggesting that more research needs to be done into methods to reverse this trend. With the decrease in physical activity and HRF within the adolescent population, effective instructional strategies need to be incorporated in every day physical education. By providing teaching that concentrates on the how and why of being healthy, students are given the tools needed to lead long, healthy lives.

CHAPTER 4

Conclusion

The purpose of this dissertation was to examine the efficacy of the PSI teaching model in teaching HRF in a high school setting. The HRF curriculum utilized a 16 module format to teach concepts of nutrition, program assessment and design, fitness components, and resistance training skills during a 6-week study period. A two-study approach was used to examine: (1) the feasibility of using PSI to teach HRF in a high school personal fitness class, and (2) changes in HRF content knowledge and in class physical activity in a personal fitness class using PSI compared to a personal fitness class using DI. The first study employed a mixed methods approach while the second used a quantitative methodology. The following section reports a summary of for each study as well as implications of the results of the dissertation.

Summary

Study 1

Study 1 was designed to investigate the implementation of a HRF unit in a high school physical education class using the PSI teaching model. PSI has shown to be an effective instructional model for teaching HRF concepts within physical education (Colquitt, Pritchard, & McCollum, 2011; Hannon, Holt, &

Hatten, 2008; Pritchard, Penix, Colquitt, & McCollum, 2012). One physical education class from a private high school in the urban area of a major city within the Mountain West region of the US participated in this 6-week study. Using confirmation criteria established in the literature (Cregger & Metzler, 1992; Hannon, Holt, & Hatten, 2008), this study examined 4 characteristics and 12 design features of PSI. The results showed that the confirmation criteria for mastery learning, teacher as motivator, and emphasis on the written word were met. The characteristic of self-pacing did not fully meet the established criteria, failing to meet two of the four design features, high rate of cues (0.54 occurrences per minute) and high rate of task feedback (0.68 occurrences per minute). One explanation for these results could be due to the classroom teacher's initial adapting to the PSI model. He commented that at first he spent a lot of time managing students and not enough time giving feedback and cues. As the study progress, he felt he spent less time on management and more time on cues and feedback. Overall, the study was successful in meeting 83.3% of the design features suggesting that PSI is an effective strategy for teaching HRF.

Study 2

The second study was designed to explore the effectiveness of PSI versus DI on HRF knowledge scores in high school students. A second purpose was to investigate in-class physical activity between the two instructional models. Two classes (*N*=53) from a private high school in the urban area of a major city in the Mountain West region of the United States were recruited for this study. One

class (*n*=24) was taught a unit on personal fitness using the PSI model while the other class (*n*=29) was taught using DI. Over the 6-week study, both classes were taught HRF concepts and resistance training skills. HRF content knowledge was evaluated using a 45-question assessment that utilized multiple choice, true and false, and case study questions. HRF assessments scores were obtained prestudy, poststudy, and 3-week follow-up. In-class physical activity was measured using a modification of the System for Observing Fitness Instructional Time (SOFIT). SOFIT uses 5-point scale to measure student physical activity during physical education classes. Incorporating a 10-second observation/10-second record interval, 5 students are monitored throughout the class.

Results from the HRF assessment indicated that the PSI group had significantly higher scores than the DI group (p=0.03) at the end of the study. The PSI group also demonstrated a significant increase (p=0.003) in HRF scores from prestudy (13.72 ± 3.89) to poststudy (17.60 ± 6.59). Further results showed no significant differences (p=0.09) between 3-week follow-up scores (15.16 ± 5.89) and poststudy scores (17.60 ± 6.59). Results from the DI group showed no significant differences in HRF scores from pre- to poststudy (p=0.36) and poststudy to 3-week follow-up (p=0.21). A paired samples t-test showed no significant differences (t=-0.27, p=0.79) between the PSI group (21% of time spent in MVI) and the control group (20.3% of time spent in MVI) during the 6-week study. According to the results from this study, PSI is an effective instructional strategy to help students improve HRF knowledge without detracting from physical activity.

Implications

Levels of physical activity and HRF are decreasing among adolescents in the United States. This decline can be attributed to lack of participation within physical education class, one of the predominated venues for obtaining HRF knowledge that is applied to be more physically active. It has been reported that students do not engage in physical education class due to the structuring of the class and how the lessons are being taught. Traditionally, physical education is taught using DI, a teacher-centered approach that tends to concentrate more on skill development and less on HRF content knowledge. The PSI model of instruction allows for both skill development and content learning. Two of the five main characteristics of PSI, self-pacing and mastery learning, may provide the keys to engaging students in physical education classes.

Self-pacing allows students to progress through the curriculum at their own pace. Rather than progressing at the rate the teacher determines, students can quickly move through more familiar concepts and spend more time on areas that are new or need more practice. When students feel that they have control over their education, they are more inclined to engage in the material. Mastery learning provides opportunities for the students to gauge their learning. As a student works toward the completion of a module, tasks and assessment quizzes are set up to provide milestones. Rather than the traditional one attempt, students who do not meet the predetermined levels of mastery are permitted to retake the assessment until they reach mastery.

Research on PSI has shown it to be a very effective way of teaching. More research still needs to be done, but results from this dissertation research has shown it to be an effective means of teaching HRF concepts and resistance training skills.

APPENDIX A

APPROVAL LETTER

JUDGE MEMORIAL CATHOLIC HIGH SCHOOL
A Diverse, Co-Educational, College Preparatory School
LLC Series #107

I am approving Steve Prewitt at the University of Utah to work with James Cordova in a research project. The project will be a pilot test for physical fitness. The first study will be conducted in December and the second study will take place approximately six weeks later.

Sincerely,

Matthew DeVoll
Assistant Principal

650 South 1100 East Salt Lake City, Utah 84102 Phone: 801-363-8895
www.judgememorial.com Fax: 801-236-2923

APPENDIX B

INFORMED CONSENT

Parental Permission to Participate in Research

BACKGROUND

Your child is being asked to participate in a research study that examines a different way to teach personal fitness in high school. Before a decision is made, it is important to understand why this study is being done and what is required of the student. The objective of this study is to determine if there are differences in student motivation, fitness knowledge, and physical activity levels between two types of instruction.

STUDY PROCEDURE

This study will require that your child complete a range of assessments that will measure their motivation toward physical education, fitness knowledge, and how they feel about PE in general. Your child will be put into one of two groups: traditional instruction and unit based instruction. They will engage in a personal fitness unit that is part of their regular curriculum for six weeks and then complete the assessments mentioned previously. This will all take place during normal physical education classes, thus there is no need for out of school participation.

RISKS

The risks of this study are minimal. Your child may feel nervous about taking the assessment. They may also feel soreness and discomfort initially due to the body getting used to this type of activity. Considerable effort will be taken to insure privacy for your child. If your child feels uncomfortable at any time while completing the assessment, they have the option to tell their teacher and/or the researcher and be excused from participating.

BENEFITS

Aside from benefits associated with normal participation in their physical education, your child may not benefit from this study. However, we hope the information we get from this study may help develop a greater understanding of PE classes.

CONFIDENTIALITY

Any information used during this study will be kept in the strictest privacy. Data and records will be stored in a locked filing cabinet as well as a password protected computer. Only the research team will have access to this information. No names will be used or included in the publication of this study.

PERSON TO CONTACT

If you have questions, complaints or concerns about this study, or feel that your child has been harmed as a result of participation, please call Steve Prewitt at 801-581-3836 from 9am until 3:30pm, Monday through Friday.

Contact the Institutional Review Board (IRB) if you have questions regarding your rights as a research participant. Also, contact the IRB if you have questions, complaints or concerns which you do not feel you can discuss with the investigator. The University of Utah IRB may be reached by phone at (801) 581-3655 or by e-mail at irb@hsc.utah.edu.

Research Participant Advocate: You may also contact the Research Participant Advocate (RPA) by phone at (801) 581-3803 or by email at participant.advocate@hsc.utah.edu.

VOLUNTARY PARTICIPATION

As previously mentioned, it is your decision about allowing your child to participate in this study. Your child's participation is voluntary, and he or she will not be penalized or lose benefits if you refuse to allow participation or decide to stop. This does not mean that your child may not participate in their regular PE class.

COSTS AND COMPENSATION TO PARTICIPANTS

Your child will not receive any compensation for being in this study. There are no costs to you or your child other than your child's time.

OPTING OUT OF STUDY

If you do not want your child to participate in this study, please call Steve Prewitt at 801-581-3836. Steve Prewitt can be reached at this number between the hours of 9am and 3:30pm. If we do not receive a response from you by February 3rd, we will enroll your child in this study.

APPENDIX C

DEMOGRAPHIC SURVEY

Student Number: _____

Age: _____

Gender: M F

Class Period: _____

APPENDIX D

HEALTH-RELATED FITNESS ASSESSMENT

Fitness Concepts Questionnaire

1. Which is a function of body fat?
    a. Helps maintain body temperature and hormone production
    b. Shock absorption
    c. Nutrient absorption
    d. All of the above

2. Jane is a 14 year old girl who wants to know her body fat percentage. *The* sums of the skin fold measurements of her triceps, suprailiac, and thigh are 42 mm. What is Jane's body fat percentage?

    Use the following formula:

$$\text{Body Density} = 1.0994921 - 0.0009929\,(X) + 0.0000023\,(X)^2 - 0.0001392\,(\text{age})$$

X= sum of all 3 skinfolds

Now use your values of body density to find your body-fat percentage:

%fat = (457/Body Density) – 414.2

    a. 16%
    b. 19%
    c. 22%
    d. 25%

3. Jane wants to know if she is aerobically "fit." You explain to her that a good way to assess her fitness level is the Rockport One-Mile Walking Test. Using the results below, calculate her VO2max.

Rockport One-Mile Walking Test

$VO_{2max} = 132.85 - (.1692 \times \text{body mass}) - (.3877 \times \text{age}) + (6.315 \times \text{gender}) - (3.2649 \times \text{time}) - (.1565 \times \text{HR})$

Gender: Female = 0 Male = 1

- Body mass: 63.5 kg
- Age: 14
- Gender: Female
- Time: 15 min.
- Heart Rate: 150

    a. 44.2
    b. 42.4
    c. 38.6
    d. 35.7

4. Which is an example of health risks associated with poor flexibility?
    a. Demobilization
    b. Joint angulization
    c. Falls
    d. None of these

5. _____ is a defined as the ability to produce a maximal force at a given speed.
    a. Muscular strength
    b. Muscular endurance
    c. Aerobic power
    d. Anaerobic capacity

6. Which is the best example of a measure of intensity for cardiorespiratory training?
    a. 45 minutes
    b. 3 miles
    c. 85% HRmax
    d. None of the above

7. Which of the following are factors that contribute to intensity?
    a. Weight (resistance)
    b. Rest
    c. Number of sets
    d. All of the above

8. The suggested length of time for a beginner resistance training session is…
    a. 30 minutes
    b. 45 minutes
    c. 60 minutes
    d. There is no set time, just less than 1 hour

9. Which is *not* true of isometric exercise?
    a. Improves static strength
    b. Increases range of motion (ROM)
    c. Muscle stays the same length
    d. Increases strength at a particular joint angle

10. The rate of progression is determined by…
    a. Fitness status
    b. Individual goals
    c. Tolerance
    d. All of the above

For questions 11-13, use the following case study:

Your friend Robert is a 16 your old male who wants to incorporate some resistance training into his fitness routine. He is on the cross country team at his school, but has never performed any type of resistance training. Answer his questions about his routine:

11. How many times per week should he strength train?
    a. 1-2
    b. 2-3
    c. 3-4 +
    d. None of the above

12. What would be an appropriate rep range? (Remember, he is on the cross-country team!)
    a. ≤6
    b. 1-2
    c. 6-12
    d. ≥12

13. What would be an appropriate rest time?
    a. 2-5 min
    b. 1-3 min
    c. 30 s-1.5 min
    d. ≤30 s

14. Which is *not* an example of a specific short-term goal?
    a. Lose 10 pounds
    b. Lower body composition by 3 %
    c. Increase VO2max by 5-7%
    d. Increase muscle mass

15. What is the term used to describe a summary of all of the training that has occurred before this program?
    a. Exercise background
    b. Exercise status
    c. Exercise history
    d. Exercise experience

16. Your friend wants to begin an exercise routine. Which is an appropriate amount of time to spend in the warm-up, endurance, and cool down phases of his routine?
    a. 1 min/10 min/1 min
    b. 2 min/20 min/2 min
    c. 10 min/ 15 min/10 min
    d. 5 min/25 min/5 min

17. What is the primary purpose of the warm-up phase?
    a. Raise the body temperature
    b. Increase flexibility in the working muscles
    c. Deliver oxygen to the tissues by increasing blood flow
    d. Increase VO2max

18. What is the best way to measure changes in cardiorespiratory fitness?
    a. VO2max
    b. Resting heart rate
    c. Resting VO2max
    d. Cardiac output

19. Which would be the best strategy to be sure that you were walking at the appropriate intensity?
    a. Wear a pedometer
    b. Walk a certain distance every session
    c. Monitor your breathing
    d. Wear a heart rate monitor

20. Which is the most effective form of swimming to develop cardiovascular endurance?
    a. Lap
    b. Sprint
    c. Interval
    d. None of the above

21. Which type of muscle action is performed in the following description: “A person attempting a biceps curl is unable lift the dumbbell towards his/her shoulder.”
    a. Isometric
    b. Isotonic
    c. Isokinetic
    d. Concentric

22. Initial gains in strength in the first 4-6 weeks of a resistance training program are a result of…
    a. Neural Adaptations
    b. Muscle Adaptations
    c. Hypertrophy
    d. Hyperplasia

For questions 23-25, use the following case study:

Your friend Jeff has been working out for a couple of weeks but has a few questions about his routine:

23. I vary the order of my routine every day. Which of the following is the most appropriate order of exercises?
    a. Squats, bench press, bicep curl, lat pulldown, shoulder press, tricep pressdown
    b. Squats, bench press, tricep pressdown, lat pulldown, shoulder press, bicep curl
    c. Bench press, squats, lat pulldown, shoulder press, tricep pressdown, bicep curl
    d. Squats, bench press, lat pulldown, shoulder press, tricep pressdown, bicep curl

24. I have large triceps so I often skip those exercises and do twice as many bicep exercises. Is this appropriate?
    a. Yes
    b. No

25. Which rule would you explain to him to illustrate this point?
    a. All-or-None Principle
    b. Muscle Balance Rule
    c. Big-to-Small Rule
    d. None of the above

26. Which is *not* a factor influencing flexibility?
    a. Joint Structure
    b. Age and gender
    c. Connective Tissue
    d. Proper Weight Training

27. Generally speaking, females are more flexible than males.
    a. True
    b. False

28. _____ monitor changes in muscle length.
    a. Golgi Tendon Organs (GTO)
    b. Muscle Spindles
    c. Stretch Reflexes
    d. Proprioceptors

29. It is recommended that stretches are held for _____.
    a. 15 seconds
    b. 20 seconds
    c. 25 seconds
    d. 30 seconds

30. _____ is a type of stretching that utilizes speed of movement over elongation of the muscle?
    a. Dynamic Stretching
    b. Ballistic Stretching
    c. Static Stretching
    d. None of the above

31. What is the current RDA for protein (the amount recommended for most healthy sedentary people)?
    a. 50 grams per day for every healthy adult
    b. 0.8 grams per kg of body weight
    c. Twice as much for men as for women
    d. 1 gram per pound for men and women

32. What is the calorie deficit per day necessary for a person to lose about a pound of fat in one week?
    a. 1,000 calories
    b. 1,200 calories
    c. 500 calories
    d. 750 calories

33. Foods that have a high caloric density have lots of calories compared to the amount of nutrients they contain.
    a. True
    b. False

34. What is the major function of carbohydrates?
    a. Used for tissue building
    b. Long term storage of nutrients
    c. It is the body's primary energy source
    d. Important in regulation of body temperature

35. Which of the following is true regarding fats?
    a. They help build tissues
    b. Fats yield 4 kcals per gram
    c. They are a storage form of energy, and a back up fuel source for carbohydrates
    d. You should get as little fat as possible in the diet

36. What is the fluid replacement guideline for exercise?
    a. 2 cups per day
    b. 8 cups per exercise session
    c. 1 cup per 20 minutes of exercise
    d. No additional fluids are needed for exercise

37. Which of the following are functions of water in the body?
    a. Contributes to body form and structure
    b. Helps maintains stable body temperature
    c. Lubricates the moving parts of the body such as the joints
    d. All of the above

38. Which of the following can be a sign of dehydration?
    a. Urinating frequently
    b. Light colored urine
    c. Headache and fatigue
    d. All of the above

39. Which of the following can affect the body's need for water?
    a. The surrounding temperature
    b. Amount of exercise performed
    c. Functional losses of water from the body such as sweat and urine
    d. All of the above

40. Relying on thirst alone is the best method of determining fluid intake.
    a. True
    b. False

41. Pete has been told by the Doctor that he needs to begin exercising because he is at a high risk to have a heart attack. Which term best describes his behavior?
    a. Motivation
    b. Compliance
    c. Adherence
    d. None of these

42. Three months ago, Tom decided to start an exercise program and has stuck with his routine since. Which term best describes his behavior?
    a. Motivation
    b. Compliance
    c. Adherence
    d. None of these

43. Which is a strategy to avoid early dropout?
    a. Set realistic expectations
    b. Keep in mind time and effort requirements
    c. Emphasize the long-term importance of exercise
    d. All of the above

44. The purpose of keeping a food log is to help in assessing one's diet, and to determine compliance with Food Guide Pyramid guidelines.
    a. True
    b. False

45. Which method of preparing meats should be avoided?
    a. Boiling
    b. Baking
    c. Frying
    d. Grilling

APPENDIX E

PERSONAL FITNESS CURRICULUM

Introduction

to

Personal Fitness

Workbook for (YOUR) Personal Fitness Class

Introduction

Welcome to your **Personal Fitness.** Fitness is an aspect of physical education that directly relates to your physical and mental well-being and quality of life.
More directly, you must use it or lose it. Some level of fitness is necessary to maintain quality of life throughout the lifespan. You do have to work at it however to enjoy the benefits.

This course is probably different than any other physical education class you have ever taken. Because this is a self-paced fitness course, you will be learning in a way that will allow you to apply all that you learn to your own individual needs. While the teacher will be available to help you, your workbook will contain all that you need to progress through the modules. The progress you make will be your own responsibility.

Your role and responsibilities in Personal Fitness:

- Attend class regularly
- Follow class and course procedures
- Learn the content of the workbook
- Use the instructor as a resource when you have questions
- Progress at your own pace
- Work toward completing all of the learning modules

Fitness concepts/skill module sequence:

Your fitness course contains 15 modules. Your goal is to complete all of the modules. There are two types of modules: concepts and skills. In the Fitness Concepts modules, the learning tasks will focus on the comprehension of cognitive information. In the Exercise Skill Technique modules, the learning tasks will focus on the satisfactory performance of exercise techniques.

Personal Fitness Overview

1. *Dressing for class.* Proper attire is necessary for the safety of everyone in a fitness environment. Tennis shoes must be worn at all times. Loose-fitting clothes that do not restrict your range of motion are recommended. Athletic shorts are recommended. Jeans or jean shorts are unacceptable.

2. *Equipment.* All necessary equipment will be provided. Media technologies will be provided when needed. Proper care of equipment and materials is required.

3. *Workbooks.* You will be given workbook containing all modules. It is your responsibility to use in class and out of class time to progress through the modules.

4. *Practice Partners*. Learning may be enhanced in the practical modules by working with others who may provide feedback. It is recommended that you work with someone who is either in the same module or has already mastered the module.

5. *Starting Class*
    a. Come to class on time with personal workbook.
    b. Complete your stretching and warm-up routine.
    c. Begin work immediately.

6. *Self-checks, partner checks, and instructor checks.*

7. *Pass/fail grading.* The course contains 15 learning models. You must complete 12 of the 15 modules to receive a passing grade.

8. *Using your time effectively.* Your progress is your own responsibility.

Personal Fitness Modules

Below is a brief description of the layout and features of each type of module.

Each **Exercise Skill Technique** module sequence will include the following:

1. A **written introduction** of the exercises.
2. Pictures of and video-taped demonstrations proper exercise execution. When you are ready for a new series of exercises, get the appropriate video file and watch it on one of the laptops/DVD players in the gym.
3. **Performance cues** that provide verbal descriptions of correct body position for the exercise. These will coincide with the video-taped demonstration.
4. An **error analysis and correction section** for analyzing common mistakes.
5. A **My Routine** form to record weights and repetitions of exercises performed in each module.
6. A **My Exercise Checklist** form that requires the successful demonstration of each specific exercise. Your instructor must evaluate your performance and give a score of *Satisfactory* on three different exercises in order to progress to the next module.

Each **Fitness Concepts** module sequence will include the following:

1. An **introduction** to the Fitness Concepts
2. A list of your **goals** for the unit
3. **Fitness concepts**
4. A **Comprehension Quiz** to test your understanding of the concepts.

Maintaining Your Pace

It is very important that you correctly label the **My Exercise Checklist** and **My Routine** forms. I will explain to you how to correctly label the chart. At the end of each class, check off any learning tasks that you completed. You will not receive credit for the tasks that are not checked off! In addition, some tasks require that I check you off. You cannot progress to the next unit until all tasks are completed. Remember, your goal is to complete all nine units. You will have to work diligently to do so.

Module 1 – Fitness Assessment

I. Introduction:

You are about to begin the exciting process of developing your own fitness routine. There are several steps to this process:

1. Determine your current fitness level or baseline by performing a fitness assessment. The results are used to create your fitness profile.
2. Set specific training goals using your profile.
3. Design a workout routine that you can follow throughout the term.
4. Perform the fitness assessment at the end of the term to determine whether or not you reached your goals.

By learning to perform these tests, you will always be able to determine your current level of fitness. After you have performed all of the activities in the unit, you will take a comprehension quiz over assessment and the concepts of fitness. You must answer 80% of the questions correctly in order to pass the unit.

Goals

By the end of this unit, you will be able to:

1. Perform fitness tests for the following areas:
    a. Body Mass Index
    b. Cardiovascular Endurance
    c. Muscular Strength and Endurance
    d. Flexibility
2. Determine an estimation of how well your body uses oxygen by using the results of the PACER test.
3. Explain why fitness assessments are helpful when beginning a fitness routine.
4. Give a summary of your overall fitness level based on the results of the assessments.

II. Warm-up:

Cardio: Jog two laps around the perimeter of the gym.
Stretches: Hamstring, Quad, Calf, Chest

When your warm-up is completed begin working on your Fitness Profile. You can find the Fitness Profile at the end of the workbook.

III. Muscle Strength Assessments

Muscular strength is the ability to produce a maximal force at a given speed. **Muscular endurance** is the ability to make repeated contractions. The American College of Sports Medicine has made recent changes to exercise recommendations that show an increased emphasis on muscular strength and endurance for the following reasons:

- *Preserves muscle mass which provides integrity for the skeletal system*
- *Positively affects bone health*
- *Positively impacts glucose tolerance*
- *Strength of ligaments and tendons directly proportional to strength of muscle*

An appropriate level of strength improves your ability to carry out daily activities. You are able to do more with less strain! It also helps to prevent osteoporosis, a disease state of poor bone health where loss of bone increases the risk for fractures. As you can see, muscular strength and endurance are important fitness components.
You will perform the following tests to assess muscular strength and endurance: curl-up and 90^0 push-ups. Make sure that you record your results on your Fitness Profile sheet.

Testing Instructions (per FitnessGram):

Curl-Up

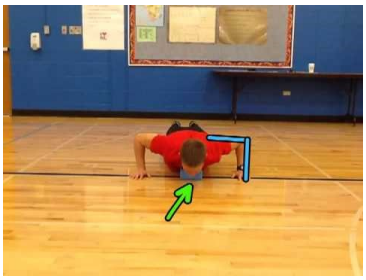
- One partner will perform the test (partner A) while the other counts and watches for form errors (partner B).
- Partner A lies in a supine position on a mat.
    - Knees bent and feet flat on the floor with legs slightly apart
    - Arms parallel with palms on the floor
- Partner A places hands on the fronts of their legs
- Partner A does slow controlled curl-ups to lift the shoulder blades off the mat and touch their knees (Figure 1).
- Curl-ups are counted when Partner A's head returns to the mat (Figure 2)
- When Partner A is ready, push play on the CD to provide appropriate cadence.
- You may stop when you reach 75 curl-ups.

Form Corrections

- Heels must remain on the mat.
- Head must return to the mat on each repetition.
- Pauses are not allowed.
- Fingertips must touch knees.

90^0 Push-ups

- Assume a prone position with hands under or slightly under the shoulders.
- Push off the mat with the arms until the arms are straight, while keeping the legs and back straight (Figure 3)
- Lower the body using the arms until the elbows bends at a 90^0 angle and the upper arms are parallel to the floor (Figure 4)
- A push-up is counted if:
  - A 90^0 angle with the elbow is achieved
  - Correct body position is maintained (straight back)
  - Arms are fully extended
- Repeat as many times as possible.
- When ready, push play on CD to begin cadence. Follow cadence.
- Typical rhythm is 1 90^0 push-up every 3 seconds. Resting or pausing is not permitted.



IV. Cardiorespiratory Assessment

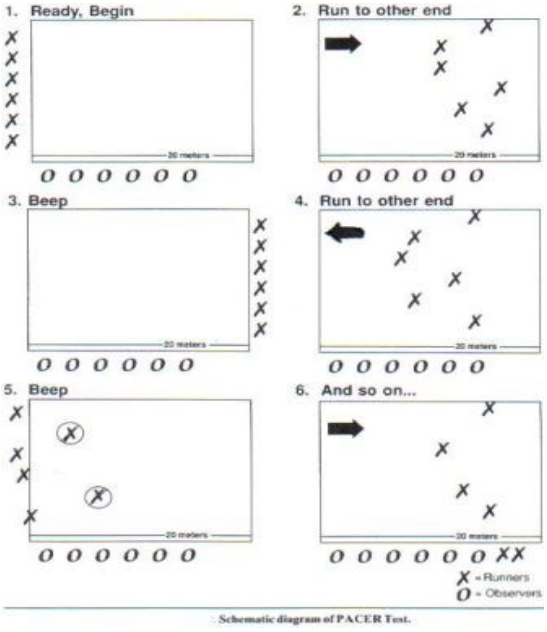
Cardiorespiratory fitness is determined by measuring your body's ability to use oxygen, a combined effort of your circulatory and respiratory systems. The more oxygen your muscles use, the better your aerobic fitness. This component of fitness is obtained and maintained by participating in *aerobic exercise* where you use large muscle groups and work at moderate to high intensities for prolonged periods of time.. Aerobic exercise choices include jogging, cycling, dancing, rowing and swimming. Exercise becomes aerobic when your body begins to use oxygen to produce energy.

Your current level of cardiorespiratory fitness will be estimated using a field test called the Progressive Aerobic Cardiovascular Endurance Run, or PACER. It is a multistage test adapted from the 20-meter shuttle run. Make sure to follow the instructions correctly.

Testing Instructions for the PACER

1. Mark a 20-meter course with cones at each end (usually sideline to sideline of basketball court (Figure 5).

2. Get into partner groups of 6-8. One person will run while the other will count and record laps.
3. Have one of the recorders push play on the CD player to begin the test.
4. When the test starts, you will have until the next beep to touch the far line with your foot. At the sound of the beep, turn around and head back to the other line.
5. Continue until you fail to reach the line before the beep for the second time.
6. If you do not reach the line before the beep sounds, turn around and continue. When you fail to reach the line a second time before the sound, you are done.
7. Record the number of laps completed on your Fitness Profile sheet.



Schematic diagram of PACER Test.

V. Flexibility

Flexibility is the ability of a joint to move through a complete range of motion. It is determined by *the articulation of bones and cartilage in the joint* and *the length and extensibility of the muscles, tendons, and fascia that cross the joint*. Flexibility is essential to function efficiently in daily activities. Flexibility is also necessary to maintain correct posture. Sedentary individuals often lack flexibility because of lack of use. *Stretching exercises* can increase flexibility and may prevent some injuries. Several factors affect flexibility including *age, gender, and race*. Flexibility generally decreases with age, especially after maturation. Females are often more flexible than males, due to anatomical and hormonal differences. Older adults typically have decreased flexibility due to inactivity. These decreases are often a factor in falls. The *Sit-and-Reach test* is a measure

of low back and hip-joint flexibility. The following is the procedure for the Sit-and-Reach test from the FitnessGram test.

Sit-and-Reach

- Perform a brief warm-up that includes stretching.
- Place a yardstick on the floor and place tape along it at a right angle to the 15-inch mark.
- Sit with the stick between the legs. Heels of the feet should touch the edge of the taped line and be about 10-12 inches apart.
- Slowly reach forward with both hands as far as possible, holding the position momentarily. Fingertips may overlap and should be in contact with the measuring stick.
- The score is the farthest point reached with the fingertips.
- To assist with the best attempt, exhale and place the head between the arms while stretching.
- Knees must remain extended at all times.
- The best of 3 trials should be recorded on your Fitness Profile sheet.

VI. Body Composition

Body composition simply defined is what you are made of or the proportions of fat, muscle, bone, and other tissues in the body. Excess body fat is the component most closely associated with risk of heart disease, diabetes and some cancers.

We have to have some fat however to be healthy. The minimum percent body fat for men is 3-5 percent and for women 9 - 12 percent. Body fat is necessary to perform certain vital functions in the body: helps maintain body temperature and hormone production, cushions organs, and stores vitamins. There are risks associated with very low levels of body fat however most of our attention will focus on levels of body fat that are too high.

In the age group 6 – 18 years, males who have body fat values greater than *25 percent* and females with values greater than *35 percent* have increased health risks which include *hypertension, dyslipidemia* (high total cholesterol or high levels of triglycerides), *type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and some cancers* (endometrial, breast, and colon).

Body fat accumulates slowly over time. Overfatness is a health risk that people are often unaware of because weight gain is gradual. Healthy choices which include activity, exercise and nutrition help keep body fat at appropriate levels. Remember that body composition is a better indicator of health than scale weight.

You may assess obesity related health issues by calculating Body Mass Index (BMI). We know that the risk of health issues increases beyond a BMI of 25. Remember, the BMI is simply a measure of weight relative to height and should not be used to assess body fatness.

BMI Instructions:

BMI = weight (kg)/height (m^2)

Step 1:

- Convert weight in pounds (lbs.) to kilograms (kg).
- Weight kg = weight (lbs.)/2.2 kg

Step 2:

- Convert height from inches-centimeters-meters.
- Height (in) x 2.54 cm
- Height (cm)/100= height in meters
- Square height in meters

Step 3:

- Weight (kg)/Height (m^2)=BMI

Example:

Student 1= weight: 100 lbs. height: 5 ft.

Step 1:

- 100 lbs./2.2 kg = 45.45 kg

Step 2:

- 5 ft x 12 in = 60 in.
- 60 in. x 2.54 cm = 152.4
- 152.4 cm / 100 = 1.52 m
- $(1.52\ m)^2 = 2.31\ m^2$

Step 3:

- 45.45 kg/ 2.31 m^2 = 19.7 BMI

Record your results on your Fitness Profile sheet.

Congratulations! You have completed your first Module! Your next step is to have your Fitness Profile checked and initialed by your partner, the TA, or your teacher.

Fitness Profile Completed _____

Your next step is to complete the Fitness Assessment Quiz. You will need to answer 8 out of 10 questions correctly. If you do not, you will need to study the information in this module a little more and try again.

Quiz Score _____/10

You will not be able to advance to any other module until you pass this one first.

MODULE 2: Cardiovascular Training

I. Introduction

Now that you have assessed your fitness levels, you are ready to hit the road running, right? Not yet. First, you need to understand some of the concepts that are behind the different forms of training and how to apply them to your routine. Remember that cardiovascular fitness is a measure of how efficiently your heart, lungs, and blood transport oxygen throughout the body. You know the basics of how to get started. This unit will provide you with an understanding of the physiological changes that occur in the body as a result of cardiovascular training. Also, you will be provided you various types of training programs, each of which are geared towards a specific training goal.

Goals:
By the end of this unit, you will:

- Understand the components of cardiovascular training.
- Understand the underlying concepts of cardiovascular training.
- Understand the benefits of cardiovascular training.
- Understand the different forms of cardiovascular training.

II. COMPONENTS OF CARDIOVASCULAR TRAINING

WARM-UP

The primary purpose of the cardiovascular system is to deliver oxygen to the tissues. During exercise, the body demands more oxygen. However, the body must gradually increase its functions in order to meet the demand. The first component of any exercise routine is the warm-up. The warm-up is the transition from rest to exercise. During this time, your heart rate gradually increases, your body temperature rises, and your blood vessels open up to allow blood to flow more easily. The warm-up may reduce the chance of injury and improve your overall performance. It is recommended that an exercise session begin with 5 to 10 minutes of aerobic activity at a lower intensity than the actual routine. For example, if your mode of exercise is a brisk walk, then your warm-up might be a light walk. If your mode of exercise is a light jog, then your warm-up should be a brisk walk.

ENDURANCE PHASE

This is the part of your routine that will actually develop cardiovascular fitness. This should consist of a continuous or intermittent activity of 20 to 60 minutes. The duration depends on the intensity. Activities of lower intensity should be longer in duration. Remember, exercise that uses large muscle groups

over longer periods of time in activities that are rhythmic in nature (such as walking, running, jogging, or swimming) produce the greatest benefits.

COOLDOWN

The cool down provides a recovery from the endurance phase. It is similar to the warm-up, except it is in reverse order. During the cool down, the intensity of your activities will slowly decrease. This allows your cardiovascular system to make several adjustments. Your heart rate and blood pressure will slowly decrease to resting levels, blood will flow back to your heart for oxygenation, and your body temperature will begin to decrease. It is important to allow yourself this time after an exercise session, as it reduces the risk of several health complications.

III. CONCEPTS OF CARDIOVASCULAR TRAINING

CARDIORESPIRATORY FITNESS

Oxygen is the most important substance in the body. Improvements in your body's ability to deliver oxygen to the working muscles results in increased endurance and many health benefits. Improvement in cardiorespiratory fitness is directly measured by the change in VO2max, which is related to the frequency, duration, and intensity of your exercise routine. Those with lower initial levels of fitness, individuals needing to lose weight and body fat, often see the greatest increases in VO2max.

OXYGEN DELIVERY

The purpose of the warm-up phase is to allow your body to reach a steady-state. A **steady-state** of exercise occurs when your cardiac output is sufficient to meet the body's demand for oxygen. When we are exercising at a steady-state, we are exercising aerobically; our body is using oxygen to produce energy. A common cause of fatigue in cardiovascular training is caused by a build-up of lactic acid, a by-product of exercise. Your body can handle lactic acid up until a certain point. As exercise intensity increase, so does your heart rate. There is a limit, called the **lactate threshold**, at which the body can no longer use the lactic acid being produced. The levels of lactic acid within the body slowly build up, and when they reach certain levels, fatigue sets in. With training, your body becomes better suited to handle lactic acid, and your lactate threshold occurs at a later point in exercise.

TRAINING

- **Baseline Training**
  - Introductory phase
  - Lays a foundation for more intense workouts
  - Toughens the body
  - Improves coordination
  - Initial workouts
    - Concentrate on volume (duration) rather than intensity

- **Stitch in the side**
  - Sharp pain in the lower rib cage on the right side of the body
  - Causes
    - Lack of conditioning
    - Weak abdominals
    - Dehydration
    - Excessive intensity
  - Stand straight up, put right arm over right side of the body

- **Pacing**
  - Running at a steady state for a given length of time
  - Beginners
    - Run in a sprint and walk pattern
    - Experience cramping and fatigue
  - Pros
    - Run in at a steady pace
    - Maintain a pace for the desired distance
    - Manipulate intensity to be able to complete a certain distance

- **Second Wind**
  - A feeling of relief from fatigue after experiencing breathlessness
  - Causes
    - Increased efficiency of circulation
    - Increased buffering of lactic acid
    - Increased circulation to the extremities
    - Increased metabolic rate

IV. BENEFITS OF CARDIOVASCULAR TRAINING

There are more advantages to increasing your VO2max than simply improving your cardiovascular fitness. Below is a list of health benefits and physiological changes associated with increases in VO2max:

PHYSIOLOGICAL CHANGES		HEALTH BENEFITS
Respiratory System	**Cardiovascular System**	
Enhanced oxygen exchange with the lungs	Increased cardiac output	Reduced risk of heart disease and early death
Improved blood flow throughout the lungs	Increased blood volume, red blood cell number, and **hemoglobin** concentration	Reduced risk of pulmonary disease
Decreased **respiratory rate**	Enhanced blood flow to muscles	Increase in physical performance
Decreased **pulmonary ventilation**	Reduced resting heart rate	Decrease in body fat
	Decrease in blood pressure	Increased metabolic rate
		Increase in energy

- **Hemoglobin**
  - The oxygen-carrying substance in the blood.

- **Respiratory Rate**
  - The number of breaths in one minute

- **Pulmonary Ventilation**
  - Breathing, or the process by which we move air into and out of our lungs

V. FORMS OF CARDIOVASCULAR TRAINING

- **Walking**
  - Underrated form of aerobic exercise
  - Must be performed at a brisk pace
  - Monitor heart rate to be sure the desired intensity is reached
  - Walking at lower intensities requires individuals to exercise for a longer period of time, 40-60 minutes, and more frequently during a week

- Advantages
  - Requires little facilities or equipment
  - Can be performed by people of all ages
  - Requires little ability and technique to be effective
  - Excellent calorie burner
  - Low-impact activity

- **Jogging/Running**
  - Growing popularity in the US
  - Many individuals participate in running as a sport rather than exercise
  - Different types of runners are classified according to distance
  - Jogging is defined as a comfortable pace of 8-12 minutes per mile
  - Running is defined as an intense pace of less than 8 minutes per mile
  - Joggers have short strides and land on their heels
  - Runners have longer strides and land on the balls of the feet
  - Advantages
    - Requires little facilities or equipment
    - Able to cover greater distances in a shorter period of time
    - Burns more calories than walking
    - Easier to maintain higher intensities

- **Aerobic Dance**
  - Very popular form of exercise throughout the world
  - Uses music to increase motivation
  - 3 types
    - Low-impact
    - High-impact
    - Combination

  - Low Impact
    - Keeps one foot on the ground at all times
    - Less intense
    - Sometimes difficult to sustain a training heart rate
    - Use arm movements and kicking steps to increase intensity

  - High Impact
    - Few movements allow both feet on the ground at the same time
    - High intensity
    - Associated with increased risk of injuries
    - Wear shoes that provide both support and cushion

- Combination
  - Low impact in the warm-up and cooldown phases
  - High impact in the training phases
  - Vary intensity according to individual needs and abilities by increasing or decreasing arm movements and speed of movements
  - For all routines, walk or jog in place if exercise becomes too intense

- Advantages
  - Low Impact
    - Easy and fun for beginners
    - Decreased risk of injuries to joints due to less pounding
  - High Impact
    - Easy to maintain a training heart rate
    - Weight bearing movements can increase bone mineral density
  - Combination
    - Provides a transition from low impact to high impact routines
    - Intense workout with decreased risk for injury

- **Swimming**
  - Very popular form of regular exercise
  - Lap swimming is most effective form for developing cardiovascular endurance
  - Requires use of both arms and legs
  - Participants must learn proper breathing
    - Inhale when face is turned out of the water
    - Exhale while face is under the water
  - Vary strokes to conserve energy and prevent muscle-fatigue from limiting performance
  - Target heart range will be 10-15 bpm less than on land
  - Advantages
    - Low impact
    - Almost no chance of injury if proper strokes are performed
    - Resistance of the water increases the amount of energy needed to move a certain distance compared to walking or running
    - Can swim for long periods of time without risk of injury

- **Stationary Aerobic Equipment: Cycles and Elliptical**
  - Popular form of cardiovascular exercise in fitness centers and health clubs
  - Monitor heart rate throughout activity
  - Adjust resistance to increase intensity
  - To prevent boredom read, listen to music, or watch TV
  - Advantages
    - Easy to use
    - Low impact
    - Convenient
    - Allows individual to work at their own pace and adjust intensities to meet individual needs
    - The controlled setting provides a more consistent and efficient workout

- **Interval Training**
  - Can be done while swimming, running, or riding stationary equipment
  - Anaerobic in nature but considered a form of aerobic training
  - Involves exercise intensities of close to VO2max
  - Work bouts last between 30 s and 5 min
  - Rest intervals equal the time of activity
    - i.e., 3 min work bout followed by 3 min rest
  - Should only be attempted after a sound base of training is developed
  - Advantages
    - Allows exercise at intensities close to VO2max for a greater period of time
    - Improves anaerobic capacity
    - Increased race performance

- **Repetition Training (REPS)**
  - Conducted at intensities greater than VO2max
  - Work bouts last between 30-90 s
  - Rest intervals at 1:5 ratio
    - i.e., 30 s work bout followed by 2 ½ min rest
  - Advantages
    - Improved speed
    - Improved running economy
    - Increased anaerobic capacity

- **Fartlek Training**
  - Combination of several types of training
  - Can be done while swimming, running, or riding stationary equipment

- Work bouts of easy activity (70% HRmax) and combined with either hill work or short bursts of intense activity (85-90% HRmax)
- Advantages
  - Challenges all systems of the body
  - Prevents boredom or monotony
  - Enhanced cardiovascular endurance
  - Enhanced anaerobic capacity

VI. Activity

For this module's activity, you will use one of the above mentioned types of cardiovascular training. Interval training can be used several ways. One way is through time intervals. Jog or run for a set amount of time then lower your intensity for another amount of time. Try to use an equal ratio of work to rest (1 minute run, 1 minute walk). A second type is distance intervals. This works best on a track. You can run the straights and walk or jog the corners. Choose which you will do for 10 minutes total. Have your partner initial that you completed this task.

Task Completed _____

VII. Quiz time

As with all modules, now that you have gone through the information, you will be tested over it. Complete the Cardiorespiratory Quiz. Remember, you need 8 out of 10 to pass.

Quiz Score _____/10

MODULE 3: RESISTANCE TRAINING

I. Introduction

This module will cover the principles and benefits of strength training. You will also learn about appropriate technique, safety and terminology. At the completion of this module you will have a foundation of understanding that allows you to participate in a safe and effective strength training program.

Now that you have a firm understanding of cardiovascular training, you are ready to develop an understanding of strength training. This module will provide you with the underlying concepts of strength training, and explain what happens to your body when you begin a resistance training program. You will also learn some of the benefits of strength training, which you may or may not already know. Finally, you will learn some more practical information which you will use in the practical modules. Technique fundamentals are vital to someone beginning a resistance training program. There are also key terms that you will need to be familiar with when you begin learning how to perform certain exercises. This module is not meant to turn you into a guru, but to instead lay a foundation of understanding and provide you with enough information to safely and competently learn the exercises in the gym.

Goals:
By the end of this unit, you will:

- Understand the underlying concepts of resistance training.
- Understand the technique fundamentals of resistance training.
- Understand the benefits of resistance training.
- Understand the key terms of resistance training.

II. CONCEPTS OF RESISTANCE TRAINING

MUSCLE STRUCTURE

- 3 Types of muscle based on structure and function
  - Smooth
  - Skeletal
  - Cardiac

- Skeletal Muscle
  - Approximately 400+ skeletal muscles in the human body
  - Makes up 40-50% of body weight
  - Functions
    - Force production for posture
    - Force production for movement

        - Heart production
- Motor neuron
    - Nerve cell
    - Communicates between muscle fibers and the brain
    - A single motor neuron can connect to hundreds of muscle fibers
- Motor unit
    - The basic functional unit of muscular activity
    - A motor neuron and all of the muscle fibers it is attached to

- All-or-None Principle
    - When a motor neuron receives a signal, either all of its muscle fibers contract or none at all

MUSCLE ACTIONS

- Isometric
    - Static
    - Tension develops in a muscle but no observable strengthening or shortening occurs
    - Sticking point in a repetition
    - Momentary pause in movement
    - Example
        - A person attempting a biceps curl is unable lift the dumbbell towards his/her shoulder

- Concentric
    - Tension develops in a muscle and the muscle shortens
    - The “working” or “lifting” phase of a repetition
    - The work done in this phase is called positive work
    - Example
        - A person attempting a biceps curl is able to produce enough force to bring the dumbbell towards his/her shoulder (Up phase of lift)

- Eccentric
    - Tension is present but the muscle lengthens instead of shortens
    - The “lowering” or “lengthening” phase of a repetition
    - The work done in this phase is called negative work
    - Primarily responsible for muscle soreness
    - Example
        - A person attempting a biceps curl slowly lowers the weight until his/her arm is extended (slow Down phase of lift)

ADAPTATIONS TO RESISTANCE TRAINING

- Strength
  - The ability to exert a maximal force during a single effort.
  - Specific to a muscle or muscle area
  - Influenced by neural adaptations, muscle adaptations, and fiber type composition

- Neural Adaptations
  - Occurs when the nervous system learns how to work with the muscular system to produce strength
  - Motor neurons are “taught” when to transmit a signal to their muscle fibers
  - An improvement in technique and coordination allow one to handle more weight with less effort
  - Initial gains in the first 4-6 weeks of a resistance training program are a result of this

- Muscle Adaptations
  - Hypertrophy
    - Increase in the cross-sectional area (size and diameter) of existing muscle fibers
    - Thin proteins within the muscle cell increase in size, causing the muscle cell and overall muscle to increase
    - Muscle size increases are most often the result of this
  - Hyperplasia
    - Muscle fibers split lengthwise and form new muscle cells
    - Recent studies have shown that this rarely occurs

- Fiber Type Composition
  - Determined by genetics
  - Every individual is born with a certain number of muscle fibers, some more than others
  - Each of these fibers is already categorized as either fast, slow, or intermediate
  - Each person is born with a different proportion of fibers
  - Those individuals with a higher percentage of fast-twitch fibers have more genetic potential for muscle growth

DELAYED ONSET OF MUSCLE SORENESS (DOMS)

- Immediate Responses to Exercise
  - Damage to muscle cells
  - Loss of force production capability

- Delayed Responses to Exercise
    - Force production worsens, slowly returns
    - Inflammation within the muscle
    - Decreased range of motion
    - Damage to muscle cells worsen and slowly improve

- Causes of Damage and DOMS
    - False Causes
        - Muscle spasm
        - Increased lactic acid
    - True Causes
        - Cellular damage due to forced lengthening (eccentric contraction)
        - Force loss

III. TECHNIQUE FUNDAMENTALS

HAND POSITIONING

- Pronated Grip
    - Palms down and knuckles up
    - Also called the overhand grip

- Supinated Grip
    - Palms up and knuckles down
    - Also called the underhand grip

- Neutral Grip
    - Palms face each other, knuckles out
    - Also called the handshake grip

- Alternated Grip
    - One hand is pronated and the other hand is supinated

- Hook Grip
    - Similar to the pronated grip
    - The thumb and index fingers are on the same side of the bar
    - Typically used in exercises requiring a stronger grip

- Closed Grip
    - Refers to all grips in which the thumb wraps around the bar

- Open Grip
    - Refers to a grip in which the thumb does not wrap around the bar
    - Also called a false grip

- Grip Width
    - Placing the hands at the proper distance from each other is key to proper hand positioning and safety
    - All widths should result in a balanced, even bar
    - 3 types of widths
        - Common
        - Wide
        - Narrow

BODY POSITIONING

- Stable Body Positioning
    - Allows proper body alignment during an exercise
    - Safely places stress on muscles and joints
    - Standing Exercises
        - Typically require feet to be positioned slightly wider than hip-width with the heels and balls of the feet in contact with the floor
    - Machines
        - Typically require proper adjustments of the seat or resistance arm and fastening belts snuggly

    - Seated or Supine Exercises
        - Require correct posture
        - 5 point body contact position
            - Back of the head
            - Upper back/shoulders
            - Lower back/buttocks
            - Right foot
            - Left foot
        - Promotes stability and spinal support

RANGE OF MOTION AND SPEED

- Exercises performed in the entire range of motion (ROM) promote maximum benefits and maintain flexibility
- An exercises full ROM should mimic the maximum ROM that can occur at that joint
- Performing movements in a slow, controlled manner allows the exercises to be performed in full ROM

BREATHING

- Must also be slow and controlled
- Essential to supply the body with oxygen and blow off carbon dioxide produced during resistance training
- Sticking Point
    - The most strenuous portion of a repetition
    - Occurs at the end of the eccentric phase and the beginning of the concentric phase
- Exhale through the sticking point
- Inhale during the less stressful phase (eccentric)
- This applies to most resistance training exercises

LIFTING A BAR OFF THE FLOOR

- Feet should be positioned slightly wider than hip-width
- Back should be erect, with the chest poked out
- Lift with the legs, not the back
- Keep the bar close to the body and your back flat as you lift upward

RESPONSIBILITIES OF THE SPOTTER

- Remove all loose plates and dumbbells from the area
- Be sure the weight to be lifted is safe and secure
- Be sure the weight is evenly loaded
- Place your body in a good lifting position (knees flexed and back flat)
- Effectively communicate with the person you are spotting (know how many repetitions are to be completed)
- Use the appropriate grip (closed) with the proper hand location
- Be alert and quick to respond in dangerous situations
- Know how and when to guide the bar in the correct path
- Know when and how much lifting assistance is needed to complete the exercise
- Suggest appropriate form changes if necessary

RESPONSIBILTIES OF THE LIFTER

- Communicate the number of reps you intend to complete before the exercise begins
- Indicate when you need assistance

- Always stay with the bar. Do not release the bar until you complete the exercise
- Select appropriate loads and repetitions (when in doubt, start too light)

IV. BENEFITS OF RESISTANCE TRAINING

- Increase muscle size and tone
- Increase size and strength of tendons and ligaments
- Reduce risk of common injuries
- Reduced factors associated with coronary heart disease, diabetes, and osteoporosis
    - Improved body composition
    - Decreased resting heart rate
    - Improved glucose metabolism
    - Increased bone mineral content
- Improved performance
    - Increased strength
    - Increased power
    - Improved vertical jump
    - Improved sprint speed

V. KEY TERMS

Below are some key terms that will help you understand written instructions in the practical modules.

EXERCISE RELATED

- Multi-joint exercises
    - Involving two or more primary joints
    - i.e., bench press, squat, lat pulldown (back), or shoulder press

- Single-joint exercises
    - Involving only one primary joint
    - i.e., bicep curl, tricep pushdown, leg extension (quadriceps), chest fly, or front shoulder raise

- Core exercises
    - Recruit one or more large muscle areas (i.e., chest, back, shoulder, hip or thigh)
    - Multi-joint exercises

    - Receive priority when selecting exercise because they often work one or more body parts
    - i.e., 1. bench press, 2. shoulder press, 3. tricep pushdown

- Assistance exercises
    - Usually recruit smaller muscle areas (i.e., biceps, triceps, abdominals, or calves)
    - Single-joint exercises
    - Usually performed after core exercises

- Big-to-Small Rule
    - Applies to any resistance training program
    - Core exercises that work larger muscle groups are performed first in the workout routine (before assistance exercises)

- Agonist
    - The muscle or muscle group actively causing the movement
    - i.e., the biceps in the bicep curl

- Antagonist
    - The passive muscle
    - Located on the opposite side of the limb
    - i.e., the triceps in the bicep curl

- Muscle Balance
    - Important goal of any resistance training program
    - The proper ratio of strength, power, and endurance of one muscle group relative to another muscle group

- Repetitions
    - The number of times an exercise can be performed

- Set
    - Repetitions performed sequentially before a rest period
- Load
    - The amount of weight given to a set

- Rest Period
    - The time given to recovery between sets or exercises

<u>DIRECTIONAL</u>

- Anatomical Position
    - All descriptions are expressed in relation to this
    - Head, eyes, and toes directed forward (anteriorly)

    - Upper limbs by the sides with palms facing forward (anteriorly
    - Lower limbs together with the feet directed forward (anteriorly)
- Anterior
    - Front of the body

- Posterior
    - Back of the body
- Superior
    - Upper
- Inferior
    - Lower
- Distal
    - Away from the point of origin
- Proximal
    - Close the point of origin
- Midline
    - The middle of the body
    - Divides the body into 2 equal halves
- Medial
    - Towards the midline
- Lateral
    - Away from the midline

ACTIONS

- Flexion
    - Bending of a part or decreasing the angle between body parts
    - i.e., bicep curl, leg curl, or front shoulder raise
- Extension
    - Straightening a part or increasing the angle between body parts
    - i.e. triceps pushdown, back extension, leg extension (quadriceps), squat, bent over lateral raise (shoulder)
- Abduction
    - Moving away from the midline of the body
    - i.e., Shoulder press or bent over lateral raise (shoulder)
- Adduction
    - Moving toward the midline of the body
    - i.e., bench press or lat pulldown (back)
- Rotation
    - Moving a body part around its axis
    - Internal Rotation
        - Moving a body part around its axis towards the midline of the body
        - i.e., arm wrestle movement
    - External Rotation

    - Moving a body part around its axis away from the midline of the body
    - i.e. reverse arm wrestle movement
- Pronation
    - Turning the palm downward or posteriorly
    - i.e., specific wrist curl (forearms)
- Supination
    - Turning the palms downward or posteriorly
    - i.e., specific wrist curl (forearms)
- Elevation
    - Raises a body part
    - i.e. (lifting phase) shrug (trapezius)

- Depression
    - Lowers a body part
    - i.e. (lowering phase) shrug (trapezius)

VI. Task

Before you attempt the module quiz, you will need to demonstrate your new knowledge to somebody. Using the list below, demonstrate the different actions, grips, and body directions. Have them sign off on the correct ones. You will need to get 100% correct to move on.

Task	**Initial**	**Task**	**Initial**	**Task**	**Initial**
Flexion	_____	Medial	_____	Overhand grip	_____
Extension	_____	Lateral	_____	Underhand grip	_____
Abduction	_____	Anterior	_____	Neutral grip	_____
Adduction	_____	Posterior	_____	Alternated grip	_____

100% Initial _____

You may now take the quiz for this module. Remember that you need to score 8 out of 10 to move on. After passing the quiz, you may want to do some of the skills modules, or you can chose to keep working on the concepts.

Quiz Score _____/10

MODULE 4: FLEXIBILITY TRAINING

I. Introduction

This module will cover the concepts of flexibility training. You will also learn about appropriate technique, safety and terminology. At the completion of this module you will have a foundation of understanding that allows you to participate in a safe and effective flexibility training program.

Goals

By the end of this unit, you will:

- Understand the underlying concepts of flexibility training.
- Understand the types of stretching that promote flexibility training.
- Understand the stretching exercises that promote flexibility training.

II. CONCEPTS OF FLEXIBILITY TRAINING

FLEXIBILY DEFINED

- Range of Motion (ROM)
  - The degree of movement available at a joint
  - Affected by several factors

- Flexibility
  - A measure of the ROM at a particular joint
  - An often overlooked component of fitness
  - Good flexibility reduces the risk of injuries and promotes good athletic performance

- Static Flexibility
  - The range of movement at a joint when enacted on by an external force such as gravity, a partner, or a machine
  - No voluntary muscular activity

- Dynamic Flexibility
  - The range of movement at a joint during movement
  - A voluntary muscle action

FACTORS INFLUENCING FLEXIBILITY

- Joint Structure
  - Determines the ROM
  - Different types of joints are classified according to the shapes of the bones' surfaces

  - Ball-and-socket joint: hip and shoulder
  - Modified hinge joint: knee

- Age and Sex
  - Young people are more flexible than older people
  - Fibrosis
    - A process in which fibrous connective tissue replaces degenerating muscle fibers in older people
  - Females are more flexible than males
    - Structural differences
    - Anatomical differences
    - Differences in types of activity

- Connective Tissue
  - Improvements in ROM as a result of stretching are primarily due to adaptations in connective tissue
  - Tendons, ligaments, joint capsules, and skin can limit ROM
  - The elastic and plastic properties of a connective tissue are different for everyone

- Improper Weight Training
  - A complete and proper resistance training program should improve flexibility
  - Performing heavy resistance training exercises with a limited range of motion may actually decrease ROM
  - Always perform every exercise through a full ROM
  - Train the “total body”- perform exercises for agonist and antagonist muscles
- Increases in Weight
  - A large increase in muscle bulk or fat may decrease ROM by hindering joint movement
- Activity Level
  - Active people are more flexible than inactive people
  - Activity alone cannot increase flexibility
  - Stretching exercises must be incorporated into physical activity to significantly improve flexibility

III. TYPES OF STRETCHING

- Static Stretching
  - Slow and constant
  - The stretch is held for 30 s
  - The muscle is relaxed, then slowly stretched until of mild discomfort
  - By performing the movement slowly, the stretch reflex is avoided

  - Easy to learn
  - Poses no real disadvantages

- Ballistic Stretching
  - Involves a voluntary muscle action in a bouncing like movement where the end is not held
  - Utilizes speed of movement over elongation of the muscle
  - Usually activates the stretch reflex
  - May injure muscles and connective tissues

- Dynamic Stretching
  - Involves stretching while performing sport specific movements
  - Utilizes speed of movement without the bouncing
  - Mimics movement patterns specific to a sport
  - These movement patterns are often exaggerated to increase the ROM and stretch the connective tissues stressed in the movement

GUIDELINES AND CAUTIONS

- A general stretching routine that exercises the major muscle groups using static techniques
- Warm up before beginning a stretching routine
- Stretching should be performed a minimum of 2-3 days per week
- Stretch only to a point of mild discomfort
- Hold each stretch for 30 seconds
- Perform each stretch 3-4 times
- Pain is an indication of injury and should not be ignored
- Avoid overstretching ligaments and joint capsules
- Target muscles that are tight and inflexible
- Always perform stretches in a slow and controlled movement
- Breath while stretching

IV. STRETCHING EXERCISES

UPPER BODY

- Look right and left
  - Stand or sit with the head and neck upright
  - Keeping shoulders facing forward, turn the head to the right to a point of mild discomfort
  - Keeping shoulders facing forward, turn the head to the left to a point of mild discomfort

- Flexion and Extension
  - Stand or sit with the head and neck upright, flex the neck by tucking the chin toward the chest
  - When the chin touches the chest, try to move the chin lower on the chest
  - Extend the neck by lifting the head up, trying to touch the head to the back

- Seated Chest Stretch
  - Sitting with legs and arms straight, grab both hands behind your back.
  - Gently lift your hands until you feel a gentle stretch in your chest and shoulders.

- Behind the Neck Stretch
  - Standing or sitting, flex the right elbow until the hand is pointed down the spine
  - Grasp the right elbow with the left hand
  - Pull the elbow behind the head with the left hand

- Arm Cross
  - Stand with left elbow slightly flexed and the arm across the chest
  - Grasp the left elbow with the right hand and pull it across the chest

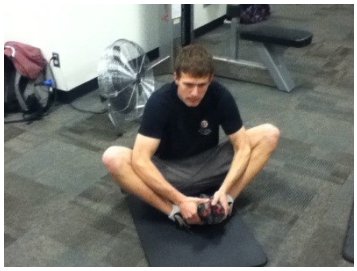
- Arms Over Head
  - Stand with the arms straight, palms out, and fingers interlocked
  - Slowly raise arms over the head, keeping the arms straight
  - Continue reaching upward with the hands and arms

<u>LOWER BODY</u>

- Quadriceps Stretch
  - Lie on the left side with both legs straight
  - Place the left arms on the floor for support
  - Flex the right leg, moving the heel toward the buttocks
  - Grasp the right leg with the right arm and pull towards the buttocks

- Modified Hurdler Stretch
    - Sit with one leg outstretched and the other with leg bent.
    - With “soft” knees lean forward until you feel a stretch in the back of your long leg.
    - Leading with the chest will help concentrate the stretch to your hamstring muscles.

- Butterfly
    - Sitting up, bring the soles of the feet together, flexing the knee
    - Pull the feet towards the body
    - Place hands on feet and elbows on legs
    - Lean forward as elbows push down



v. Task

Your task for this module is to demonstrate your knowledge of stretching exercises. Show someone 3 upper body stretches and 3 lower body exercises. Have them sign off after you have successfully completed the task.

Initials _____

You may now attempt the flexibility module quiz. If you do not achieve 8 out of 10, review and try again.

Quiz Score _____/10

MODULE 5: FITNESS PRINCIPLES

I. Introduction

Many people today have poor personal fitness because *they do not have the knowledge they need to know how to improve*. Now that you have performed fitness assessments and completed your Fitness Profile, you can see what components of fitness that you need to either improve or maintain. All fitness programs should include both cardiorespiratory and strength training. The FITT principle will guide you through your program design. FITT stands for frequency, intensity, type and time (duration). You will change these workout variables over time according to your fitness goals.

Goals

By the end of this unit, you will:

- Understand the FITT principles
- Be able to apply the FITT principles to your training program
- Develop a cardio and strength routine appropriate for your fitness level. This should be a routine you could maintain for 2 – 3 weeks.
- Understand the principles of overload and progression
- By applying the principles of progression and overload, develop a 3 week continuation of your program.

II. FITT Principles

- **Frequency**
  - How often you exercise
  - i.e.- the number of days per week
- **Intensity**
  - How hard you exercise
  - i.e.- % of **HR_{max} (age predicted maximal heart rate)**
- **Time**
  - The duration of one bout of exercise
  - i.e.- 45 minutes per day
- **Type**
  - Strength or cardiorespiratory
  - The mode of exercise: bike, treadmill, free weights, machines

FREQUENCY

Resistance Training

The recommended frequency for resistance training in beginners is 2-3 days per week. Muscle groups need a minimum of 24 -48 hours to recover... Many people begin with two to three days per week, making sure there are one

to two days of rest between strength workouts. This allows the body to recover from the previous exercise session.

The following are examples of the alternate and the split routines.

Training Day	**Muscle Groups**			**Example Training Week**			**Type of Frequency**
		M	*TU*	*W*	*TH*	*F*	
1	Total Body	Total Body	Rest	Total Body	Rest	Total Body	Alternate
1 2	Lower Body Upper Body	Lower Body	Upper Body	Rest	Lower Body	Upper Body	Split
1 2 3	Chest, shoulders, triceps Lower Body Back, trapezius, biceps	Chest, shoulders, triceps	Lower Body	Back, trapezius, biceps	Rest	Chest, shoulders, triceps	Split

Cardiorespiratory Training

Cardiorespiratory fitness can be developed by performing 3-6 training sessions per week. When just getting started, you should allow for a day of rest between workout sessions. Frequency is most closely associated with injury so rest days play an important part of your success.

INTENSITY

Resistance Training

The **intensity** of resistance training is a measure of effort of a single training session. A combination factors contribute to intensity: *weight, number of repetitions, length of rest between sets, and the total number of sets of exercises performed*. The appropriate intensity for a beginner is 1 set of 8-12 repetitions to fatigue. The ACSM states, “Resistance training of moderate intensity (i.e.,

sufficient to develop and maintain muscular fitness and fat-free mass) should be an integral part of adult fitness and rehabilitative exercise programs (2000)."

Cardiorespiratory Training

The **intensity** of cardiorespiratory training can be stated as a percentage of your age-predicted maximal heart rate (**HR_{max}**). There is a linear relationship between HR and %VO2. As your HR increases, so does your oxygen consumption (VO2). Your age predicted HR_{max} can be found using the following formula: HR_{max} = 220 – age. Once you know your age predicted HR_{max}, you can determine what intensity is appropriate for you. The following are descriptions of intensities based on HR_{max}: Low, 40-50%; Moderate, 65-75%; High, 75%-90%. If you are just beginning an exercise program, you may want to begin at low-moderate intensity. It is best slowly increase the intensity of your training over a period of several weeks until you are able to exercise in the range that is needed to improve or maintain $VO2_{max}$, 70 to 85%.

TIME / DURATION

Strength Training

The principle of **time** is simply the duration of a single exercise session. This will depend on several factors that are all related to your individual training goals. To start, you should perform a minimum of 8-10 separate exercises that train the major muscle groups with a minimum of 1 set of 8-12 repetitions per exercise in a time efficient manner. Sessions that last longer than 1 hour often result in higher dropouts.

Cardiorespiratory Training

The duration of your cardiorespiratory workout is directly related to your personal goals. The ACSM recommendations for time are as follows: 20-60 minutes of continuous or intermittent (minimum of 10-minute) bouts of cardiorespiratory activity over the course of a day (2000). Exercising for 20 to 30 minutes at a moderate intensity (excluding the time spent in a warm-up and cool down) is sufficient for most people to achieve their fitness goals (Butcher et al 1998). You should gradually increase your time over a period of several weeks until your goal is achieved.

TYPE

Resistance Training

There are two phases of an exercise, the *concentric* (lifting phase) and the *eccentric* (lowering phase). There are 3 **types** of resistance training exercises

that are classified according to the work done in each phase. The first, **isometric**, is a type of exercise in which the muscle remains the same length. These are performed to improve **static** strength, the muscles ability to exert force at a specific angle. These exercises involve no movement and build strength in only one position. The other two types of exercises work to build **dynamic** strength, the muscles ability to exert force through a range of movement. The second type of exercise is termed **isokinetic**. These exercises are performed mainly in a rehabilitative setting with specialized machines that control the speed and resistance of the movement, which in turn require only concentric contractions. The third and most common type of exercise is **isotonic**. These exercises involve both concentric and eccentric phases and are closely related to everyday activities. Although each type of exercise has its advantages, isotonic, dynamic exercises performed though a full range of motion at low-moderate speeds are recommended for most people.

Cardiorespiratory Training

Cardiorespiratory training can take many forms, but the greatest improvements in VO2max are seen when the activity or exercise meets the following criteria: uses large muscle groups, performed over prolonged periods of time, and are aerobic in nature (ACSM 2000). Many activities can be considered as a form of cardiorespiratory training, such as walking, running, cycling, swimming, hiking, rowing, and dancing. You need to choose a form of training that you enjoy. You need to choose an intensity that results in feeling like you are working somewhat hard to hard.

OVERLOAD

The principle of overload refers to increasing the intensity of training to one that is greater than previous sessions. This is done by changing the intensity, duration or frequency of your training. You can overload your resistance training regimen by increasing the weight, increasing the number of sessions per week, adding exercises or sets, and decreasing rest periods. You can overload your cardiorespiratory training regimen by increasing the number of sessions per week, increasing the intensity (% HRmax), and/or increasing the duration of each session. You should change no more than one component at a time. Use the 10% rule! Increases should be no more than approximately 10% at a given time.

PROGRESSION

In order to continue toward your fitness goals, the intensity of your routine must become progressively greater. The recommended rate of progression is determined by your *fitness status*, *individual goals*, and *tolerance* of the current level of training (ACSM 2000). Even though you have been given examples of

minimal amounts of cardiorespiratory and resistance training exercises, your routine may start at a different level of training. A beginner might start resistance training with a minimum of 8-10 separate exercises that train the major muscle groups with a minimum of 1 set of 8-12 repetitions to fatigue per exercise, performed 2-3 days per week. When beginning a cardiorespiratory training regimen, you start at an intensity that allows you to talk but not gasp for breath. You should choose an intensity that you can maintain for 20 to 30 minutes without experiencing undue fatigue. Your aerobic time excludes warm-up and cool-down. A minimum of 3 days per week should be dedicated to cardiorespiratory training. Remember, these are starting points. From here, intensity needs to be increased.

Example: *Resistance Training*

Frequency	3 days per week, M,W,F
Intensity	moderate: - 8 exercises; 1 for every major muscle group - 1 sets per exercise - 10-12 rep range
Type	machines/selectorized (i.e.- cybex, lifefitness)
Time	enough to perform major muscle group exercises with 45 seconds rest between sets

Cardiorespiratory Training

Frequency	3 days per week, m, w, f
Intensity	moderate: - HRmax = 200 - 130-150
Type	stationary bike or treadmill
Time	- Warm-up: 5 minutes - Endurance: 20 minutes - Cool down: 5 minutes

VI. Task

Complete the Fitness Principles quiz and score 8 or better out of 10. Once this is done, you can move on to the next module.

Quiz Score _____10

MODULE 6: PROGRAM DESIGN

I. Introduction

Now that you have an understanding of fitness principles, you can begin the process of designing your own workout routine. In this process, called **program design**, you apply fitness principles to your own needs and desires. Program design involves 3 stages: goal-setting, manipulating workout variables, and designing your routine.

Your fitness assessment revealed baseline scores that provide a starting point for your program design.. Based on that knowledge, you will write out your training goals. It is important that these goals are specific and measurable. Next, you will learn how to appropriately progress from week to week by manipulating the fitness principles. Finally, you will actually write out your workout routine in detail.

Goals

By the end of this unit, you will:

- Understand the stages of program design and apply them to your own workout routine
    - Be able to set realistic training goals based on your Fitness Assessment scores
    - Be able to manipulate workout variables to progress toward your goals
    - Be able to write out your specific workout routine based on your goals

II. GOAL SETTING

Setting goals gives purpose and direction to the training program and promotes *intrinsic motivation, self-confidence, and self-responsibility*. First, you must set the right type of goals. The ACSM recommends goals that are *short-term*, yet *flexible*, in addition to long-term goals.

If you want to change, you have to know what you want to accomplish and how to accomplish it. How fast you change depends on two factors: the **intensity** of the workouts and your **genetic potential** for change. While the intensity of the workout is an important factor, the intensity must gradually increase until the maintenance phase is reached. You must practice patience as some are able to progress faster than others. Remember, short-term, flexible goals are the most effective. Goals should also be specific and measurable. Goals provide a way to monitor your improvement and motivate you to continue your routine. You WILL see improvements over time. Below are some examples of short-term goals. Remember to first address the components of fitness that are below average or average.

My Short-Term Goals

6 week example

Fitness Component	**Goal**
Cardiorespiratory Fitness	Increase VO_{2max} by 5-10%
Body Composition	Decrease body fat percentage by 2-4 %
Flexibility	Increase Sit-and-reach by 1-3 inches
Muscle Strength & Endurance	Increase number of Curl-ups by 3-6 Increase number of 90^0 Push-ups by 3-6

III. MANIPULATING WORKOUT VARIABLES

You need to be aware that if you are first beginning an exercise routine, you need to progress gradually. The National Strength and Conditioning Association has some guidelines for beginners based on training *status, exercise history*, and *exercise technique experience* (see Table A). **Training status** is your current level of condition, or how prepared you are to start a routine. Your **exercise history** is a summary of all of the training that has occurred before this program. Your **exercise technique experience** refers to the knowledge and the skill to perform resistance training exercises properly. If you are unsure about your place in these categories, it is best put yourself in the lowest category. Starting a program at an intensity or frequency that is too high, or that involves exercises that are too difficult will result in minimal results or burnout. Start conservatively, and allow yourself to progress slowly.

There is another table (Table C) that summarizes the recommendations of the NSCA related to various resistance training goals in their book *Essentials of Strength Training and Conditioning*. The only resistant training goal that is not self-explanatory is hypertrophy. Hypertrophy as a training goal that refers to an increase in muscular size.

A good way to determine an appropriate weight is to choose a weight that is moderate to very difficult during the last few repetitions but allows you to maintain good form. This means that if your protocol is 3 sets of 10-12 repetitions, then choose a weight that is challenging to perform 10 reps on the 3rd and final set, with good form. As you progress, you may want to train at lower repetition ranges. You can use this same rule for any rep range. However, due to other factors such as increased rest times associated with lower rep ranges, you may have to increase the weight even more.

The next thing you need to know is how to progress. For cardiovascular training, the ACSM has a recommended rate of progression for healthy adults,

and this is summarized in Table B. There is also a summary of weight increases for resistance training. As far as timing the load increases, the **2-for-2 rule** is the safest way to go. This means that if you can perform 2 or more repetitions over you're your goal repetitions, in the last set in 2 consecutive workouts, increase the weight. For example, your protocol for a certain exercise is 3 sets of 10. If you can perform 12 reps in the third set for 2 workouts in a row, increase the weight.

RESISTANCE TRAINING

Training Status and Progression Guidelines

Table A

Training Status	Current Program	Training Age	Frequency (per week)	Training Intensity	Technique Experience
Beginner (untrained)	Not training	< 2 mo	1-2	Low	None
Intermediate (moderately trained)	Currently training	2-6 mo	≤ 2-3	Moderate	Basic
Advanced (well trained)	Currently Training≤	1 + yr	3-4 +	High	High

CARDIORESPIRATORY TRAINING

Training Status and Progression Guidelines

Table B

Program Stage	Training Age	Frequency (per week)	Training Intensity (%HR_{max})	Exercise Duration
Initial Stage	1	3	40-50	15-20
	2	3-4	40-50	20-25
	3	3-4	50-60	20-25
	4	3-4	50-60	25-30
Improvement Stage	5-7	3-4	60-70	25-30
	8-10	3-4	60-70	30-35
	11-13	3-4	65-75	30-35
	14-16	3-5	65-75	30-35
	17-20	3-5	70-85	35-40
	21-24	3-5	70-85	35-40
Maintenance	24+	3-5	70-85	30-45

Table C

Training Goal	Frequency (days per week)	Exercises per muscle group	Sets per exercise	Repetitions	Rest
Strength	3-4	2-3	2-6	≤6	2-5 min
Power	3-4	2-3	3-5	1-2	2-5 min
Hypertrophy	4-6	3-5	3-6	6-12	30 s-1.5 min
Muscular Endurance	2-3	1-2	2-3	≥12	≤30 s

IV. Task

Now that you have learned about goal setting/program design and fitness principles, you need to apply that learning. Based upon your Fitness Profile results and your personal fitness goals write out some general thoughts that you may have about your future workouts. What areas are you going to concentrate on? Do you have specific weaknesses you need to address? Write your thoughts below. Have your teacher go over it for completeness. Then take the quiz so that you can move on to more modules.

_____
_____
_____
_____
_____
_____
_____

Task Completed _____

Quiz Score _____/10

MODULE 7: NUTRITION

I. Introduction

Your fitness routine plays only part of the role in maintaining your health. Equally important are the concepts of nutrition. Many of your fitness goals will be difficult to reach without making good food choices. Your body is like a machine that needs fuel. Poor eating habits fuel an exercise routine like water will fuel a sports car. You must learn to choose nutrient-rich foods in the right portions. Six nutrients needed by the body are carbohydrates, fats, protein, vitamins, minerals, and water. Of these 6 nutrients, only carbohydrates, fats, and proteins directly supply the body with energy in the form of calories.

Goals

By the end of this unit, you will:

- Understand the differences between carbohydrates, fats, and proteins.
- Be able to determine your caloric needs.
- Understand the concepts of calorie density and nutrient density.

II. NUTRIENT ANALYSIS

Carbohydrates:

- Carbohydrates are made up of glucose
- 1 gram of carbohydrates provides 4 calories (4 calories/gram)
- Carbohydrates are the body's primary source of energy, especially during exercise.
- The body can store a small amount of carbohydrates in the muscles and the liver. This storage form of carbohydrates is called glycogen, and is important for supplying energy during exercise.
- Carbohydrates should make up about 55-60% of the body's total calories for the day. Some athletes, especially aerobic endurance athletes, may need a higher percentage.
- Healthy carbohydrates include pasts, breads, fruit, cereals, crackers, vegetables
- Carbohydrates that should be limited include sugary foods such as cakes, cookies, pastries, candy, sugary cereals.

Fats:

- Fats are made up of fatty acids.
- 1 gram of fat provides 9 calories (9 calories/gram). More than twice as many as carbohydrates and protein, which is why we are told to limit fat intake to avoid gaining excess weight
- Fats are also an important source of energy for the body
- Fats should make up 25-30% of the body's total calories for the day

- Healthy fats include vegetable oils (olive, canola, safflower, sunflower), nuts, avocados, fish.
- Fats that should be limited in the diet include fatty meats, butter, cream, full fat dairy, bacon, sausage.

Protein:

- Proteins are made up of amino acids.
- 1 gram of protein provides 4 calories (4 calories/gram).
- Protein is important for building and repairing tissues in the body such as muscles, organs, the brain, hormones, and enzymes. Protein is especially important for athletes in order to build and repair muscles.
- Protein should make up 10-20% of the body's total calories for the day. Protein needs can also be expressed according to body size. Sedentary adults need 0.4 grams of protein for every pound of body weight. Athletes may need up to 0.9 grams for every pound to ensure adequate protein for tissue building and repair.
- Healthy proteins include lean meats (low-fat meats) such as chicken, egg whites, fish, low fat dairy, nuts.
- Proteins that should be limited due to high fat are fatty meats, full fat dairy,

III. Determining Calorie Needs

Energy Balance

- Body weight is maintained by balancing calorie intake from the food we eat with calorie expenditure from metabolism and physical activity (calories burned).
- If a person takes in more calories than they burn, they will gain weight
- In order to lose weight, one must burn more calories than they eat. One pound of body fat is equal to 3,500 calories, therefore in order to lose 1 pound in a week, one must burn 500 more calories per day than they eat.
- The body's need for calories is largely dependent on body size. The more one weighs, the more calories they will require. Age and gender also affect calorie needs
- Physical activity also plays a large role in calorie needs. The more physically active one is, the more calories their body requires.

The following calculation can be used to estimate calorie needs:

Males: **66.5 + (13.8 x kg) + (5 x cm) – (6.76 x age)**
Females: **665 + (9.56 x kg) + (1.85 x cm) – (4.68 x age)**

Multiply this number by one of the following depending on activity level:

Sedentary = 1.2
Light Activity = 1.3
Moderate Activity = 1.4
Heavy Activity = 1.5

(Example)---The estimated calorie needs for a 12 year old male who is 5 feet 10 inches tall and weighs 160 lbs and is moderately active would be as follows:

160 lbs/2.2 = 72.7 kg
5 ft 10 in = 70 inches; 70 in x 2.54 = 177.8 cm

66.5 + (13.8 x 72.7 kg) + (5 x 177.8 cm) – (6.76 x 23 y) = 1,803 calories
1,803 calories x 1.4 = <u>2,524 calories</u>

IV. Calorie Density and Nutrient Density:

- Foods that have a high caloric density have lots of calories compared to the amount of nutrients they contain.
- Foods that are nutrient dense have lots of nutrients compared to the number of calories they contain.
- To maintain a healthy body weight, one should eat foods that have a high nutrient density such as fruits, vegetables, whole grains, nuts, dairy, and lean meats to get enough nutrients and avoid eating too many calories.
- Foods that have a high calorie density should be limited, and include sweets such as cakes, candy, soft drinks, and cookies and foods high in fat such as french fries and pizza.

V. Task

For this module, you will need to estimate your caloric need for each of the 4 activity levels. Use the formula above and record it below. Have someone sign off on it and then attempt the Nutrition Quiz. That's right, you need to score 8 or above to pass.

Sedentary: _____
Light Activity: _____
Moderate Activity: _____
Heavy Activity: _____

Initial _____

Quiz Score _____/10

MODULE 8: FLUID BALANCE

I. Introduction

An important and often overlooked concept in fitness is fluid balance. Water is one of the 6 essential nutrients along with carbohydrates, fats, proteins, vitamins and minerals. Water is the most vital nutrient because it allows all of the processes in the body to take place. For adults, 45-65% of body weight is water. This is largely determined by one's muscle mass. The more muscle one has, the more water the body holds. Daily water requirements increase when you begin an exercise routine. In this module, you will learn how the functions of water its regulatory mechanisms in the body.

Goals

By the end of this unit, you will:

- Understand the functions of water.
- Understand the regulatory mechanisms of water.

II. FUNCTIONS OF WATER AND THIRST

Functions of water:

- Water transport nutrients to our tissues
- Helps transport waste out of the body
- Helps regulate body temperature
- Gives the body form and structure
- Acts as a lubricant for the moving parts of the body such as the joints

We obtain water for our bodies in 3 ways:

- In the liquids we drink (supply approximately 2/3 of our fluid intake)
- In the foods we eat (supply approximately 1/3 of our fluid intake)
- Our bodies produce water during metabolism

Functions of Thirst

- How much fluid we consume is controlled by thirst mechanisms.
- Relying on thirst alone is a poor method of determining fluid intake.
- By the time we feel thirsty, our bodies have already become dehydrated.
- A good guideline to help ensure adequate hydration is to consume approximately 1,000 ml of fluid per 1,000 calories consumed. This amounts to 8-11 cups a day.

Ways we lose water:

- The kidneys filter water from the bloodstream and eliminate it in the urine along with waste. This accounts for 60% of water losses from the body.
- Water is lost from the lungs during breathing. This accounts for 28% of water losses from the body
- 8% of water losses are from the skin in the form of sweat.
- Feces accounts for just 4% of water losses.

III. FLUID REGULATION

Water balance and the kidneys:

- The kidneys filter out waste from the blood and send this waste to the bladder to be eliminated in the urine along with water.
- Various hormones in the body help regulate how much water and sodium our kidneys filter out of the blood, depending on our need for fluids.
- When there is an excess of fluid in the body, the kidneys send more water and sodium to the bladder.
- When the body is dehydrated, the kidneys leave more water and sodium in the blood, and less is sent to the bladder to be eliminated from the body.

Electrolytes

- Electrolytes are minerals the body needs to maintain proper hydration and water balance.
- The major electrolytes in the body are sodium and potassium. When we exercise for more than 90 minutes, or sweat a great deal when exercising, we can lose not only excess water, but also electrolytes.
- These electrolytes need to be replenished. Drinking sports drinks such as Gatorade or Powerade, or eating foods containing sodium and potassium can help replenish electrolytes.

Factors affecting water requirements:

- Temperature
  - Natural climate or heart from physical work can cause increased water loss through sweat
- Activity Level
  - Work and exercise require more water intake because water is lost as sweat and more water is needed for increased metabolism
- Functional Losses
  - Loss of water through urine, feces, sweat, breathing. Increased loss of fluid due to illness such as diarrhea or vomiting.

- Metabolic Needs
- The work of body metabolism requires water. About 1,000ml per 1,000 calories consumed.

Fluid replenishment guidelines:

- Drink an additional 1 cup of fluid for every 20 minutes of exercise, or
- 2 cups of fluid for every pound lost during exercise

Signs of dehydration…

- Dark urine (should be approximately the color of lemonade)
- Strong smelling urine
- Infrequent urination
- Fatigue
- Headache

(Urinating is NOT a sign of complete rehydration)

IV. Task

How much water do you drink each day? How much should you drink? This task requires that you estimate how much **water** you should drink each day. Use the suggestion above and record it below. Your next task is to determine how much fluid per hour and try it. Record how well you did.

How much water I should drink every hour: _____
What benefits do I get from drinking the appropriate amount of water each day?:

_____
_____
_____
_____
_____
____

Initial Completed: _____

Don't forget to take your quiz. Quiz Score_____/10

Module 9: Abdominals and Lower Back

I. Introduction

Your abdominal and lower back muscles create what we call the "core." These are very important that provide balance, posture, and stability. Studies have shown that if our core is strong, we decrease the possibility of injury and increase whole body strength. This module will take you through different lifts to strength this area.

II. Warm-up

For your warm-up jog or walk four laps around the gym. Then make sure that stretch really well. Do three stretches for the upper body and three for the lower body, then move on to exercises.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	Muscle Action	Primary Muscles	Secondary Muscles
Crunches	Trunk flexion	Rectus abdominus	Oblique
Incline Bench Sit-Ups	Trunk flexion	Rectus abdominus	Oblique
Leg Raises	Hip Flexion Trunk flexion	Hip Flexors	Rectus abdominus oblique
Roman Chair Side Bends	Lateral flexion Trunk flexion	oblique	Rectus abdominus
Back Extension	Trunk extension Hip Extension	Erector spinae	Gluteals Hamstrings

Crunches:

1. Lying on your back, place your hands behind your head, flexing your hips and knees to a 45 degree angle
2. In the starting position, inhale
3. Exhale as you lift your shoulder off of the ground, raise your shoulders and chest in an upwards movement until you can raise up no further
4. Inhale as your slowly lower your torso to the starting position

Incline Bench Sit-Ups:

1. Lie back on the bench with the top of your feet locked under pads, placing your hands behind your head
2. Inhale as you bring your torso and head in an upwards motion until you can no longer bring yourself forward without strain
3. Exhale as you lower yourself back to starting position

Leg Raises:

1. Standing with your back towards the pad, raise your elbows onto the pads and hold the handles with a closed grip, making sure to keep your head and neck straight
2. Inhale as you bring your knees towards your chest until they are at about a 90 degree angle, making sure not to bend your upper body towards your knees
3. Exhale as you slowly lower your legs back to starting position

Roman Chair Side Bends:

1. Lie sideways on a Roman chair with your hip on the support pad and your hands behind your head
2. As you inhale, lift and twist your body upward towards the hip of that one opposite of the pad
3. Exhale as you lower yourself back to starting position

Back Extension

1. Begin in a prone position with shoulders, hips and knees in align on a Roman chair with your lower abdomen on the upper support pad and the back of the ankles under the lower support pads
2. Hands can be either crossed over the chest or behind the head
3. Lower your torso towards the floor until your upper and lower body forms a 90 degree angle
4. Slowly extend upward as your back straightens

IV. Safety Cues and Corrections

-Make sure to keep your hands behind your head
-Do not strain your neck too far forward or pull on it

Error	**Correction**
Your buttocks lift off the floor.	• Start with your upper back, lower back, and buttocks in contact with the floor. • Keep your lower back and buttocks in contact with the floor during each rep.
You use momentum to complete each rep.	• Concentrate on using only your abdominals (crunches) or lower back (back extensions) to complete each movement.
Your shoulders lower rapidly and you bounce upward.	• Slowly lower your upper back and shoulders to the starting position. • Slightly pause between each rep.
You use your hands to pull upward on your head for assistance.	• Concentrate on using only your abdominals (crunches) or lower back (back extensions) to complete each movement. • Cross your arms over your chest.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #8 Completed_____

Module 10: Hip/Thigh (Multi-Joint)

I. Introduction

The largest muscles of your body are your thigh, or quadriceps, muscles and your hamstrings. As was mentioned in a previous module, we should also try to do multi-joint exercises when we can, since movement in life is multi-joint. This module will take you through some of the basic exercises to strength your quads and hamstrings, and as an added bonus, usually your lower back as well.

II. Warm-up

Today, for your cardio warm-up, grab a jump rope. You will use this to do some intervals. Jump for 1 minute, and then take 30 seconds rest. Repeat 3 times. Finish by stretching. Emphasize the lower body today (4 stretches) and 2 stretches for the upper body.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Barbell Squats	Hip Extension Knee Extension	Gluteals Hamstrings Quadriceps	
Dumbbell Squats	Hip Extension Knee Extension	Gluteals Hamstrings Quadriceps	
Leg Press	Hip Extension Knee Extension	Gluteals Hamstrings Quadriceps	
Lunges	Hip Extension Knee Extension Ankle plantar flexion Hip Flexion	Gluteals Hamstrings Quadriceps	Hip flexors Calf
Hack Squats	Hip Extension Knee Extension	Gluteals Hamstrings Quadriceps	

Barbell Squats:

1. Position the bar on the upper trapezius
2. Stand with your feet shoulder-width apart, keeping toes pointed forward or slightly outward.
3. Position hands on bar slightly wider than shoulders with closed, pronated grip
4. Inhale deeply and slightly arch your back by rotating your pelvis forward
5. Look straight ahead and lift the bar off the rack
6. Move a step or two back, and assume above foot position
7. Slowly bend your knees and squat down, as when sitting in a chair
8. Squat down until your upper thighs are parallel to the floor.
9. Extend your legs while pressing off your heels.
10. Exhale as you complete the movement

Dumbbell Squats:

1. Stand with your feet shoulder-width apart holding dumbbells with your arms at you sides, palms facing body
2. As you inhale, keep your back straight as you slightly bend forwards as you squat with your legs, keeping arms extended straight downwards
3. Exhale as you slowly bring yourself back to starting position

Leg Press:

1. Lying back on machine, keep your head on pad, place feet shoulder-width apart on sled plate
2. Disengage rack as you inhale and begin to lower legs until they are bent at a 90 degree angle
3. Exhale as you slowly bring weight back to starting position

Lunges:

1. Stand with your feet shoulder-width apart and back straight
2. Inhale as you take one step forward then with your back leg, flex your knee to a 90 degree angle until your knee almost touches the ground
3. As you exhale, bring yourself back to staring position, then repeat with opposite leg

Hack Squats:

1. Stand with your back against machine, feet shoulder-width apart with knees slightly bent, shoulders wedged underneath pads, and hands grasping handles
2. As you release sides of weight stopper, inhale and flex your legs until knees are bent at a 90 degree angle
3. Exhale as you slowly push weight back up to starting position

IV. Safety Cues and Corrections

-Make sure not to round upper back during exercise
-Do not bounce or momentarily relax the legs or torso at the bottom of the descent

Error	**Correction**
Your upper body moves back and forth.	• Maintain a stable body position. • Keep your abdominal and lower back muscles tight. • Your head, shoulders, hips, and feet should form a straight line.
Your legs are not flexed to 90 degrees or less.	• Use a mirror or ask a partner to check the point where you reach a 90 degree angle.
Your legs are fully locked after you have lifted the weight.	• Lift the weight until your legs are straight, but not locked.
Your knees move forward as you lower the weight.	• Keep your knees over your shoe tops. • As you lift, press off of your heels.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #10 Completed_____

As you complete this module, it is suggested that you go to a module that works a different body part. This will allow your lower body a chance to rest and recover.

Module #11 Hip/Thigh (Single-Joint)

I. Introduction

Having a strong lower body helps in many ways. Naturally this is where our movement (walking, jogging, etc.) begins. It also helps us do other activities day in and day out, like climbing stairs. This module will continue to teach you additional hip and thigh exercises that support the multi-joint exercises you learned in Module #9.

II. Warm-up

If you completed module #9 within the last two days, your legs may still be a little sore. Make sure that you really do a good job of warming up and stretching. Jog/walk 4 laps around the gym. Work hard enough to get your heart rate up and feel warm. Do 3 stretches for the upper body and 3 stretches for the lower body.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Leg Extensions	Knee extension	Quadriceps	
Lying Leg Curls	Knee flexion	hamstrings	
Seated Leg Curls	Knee flexion	hamstrings	
Standing Calf Raises	Ankle plantar flexion	calf	
Seated Calf Raises	Ankle plantar flexion	calf	

Leg Extensions:

1. Sitting on machine with your lower shins positioned below pads, grasp side hand bars and place back straight against back pad
2. Inhale as you slowly extend legs forward making sure to maintain control of weight
3. Exhale as you slowly flexes legs back to starting position

Lying Leg Curls:

1. Lie face down on machine with arms gripping handles, place ankles below pads near feet
2. Inhale as you bring your legs toward your buttocks until you can no longer flex any more
3. Exhale as you slowly extend your legs back to starting position

Seated Leg Curls:

1. Sit on machine with your knees under pads closest to body, and your lower calves over pads furthest from body
2. Inhale as you slowly bring your feet towards your buttocks until they can flex no more
3. Exhale as you bring legs back to starting position

Standing Calf Raises:

1. Standing with your back straight on plate sled, place your shoulders under pads, and place weight on balls of feet
2. Inhale as you rise up as high as you can as you flex your calves, making sure to keep your knees extended
3. Exhale as you slowly lower your body back to starting position

Seated Calf Raises:

1. Sit facing machine with your knees placed under pads and the balls of your feet on plate sled, keeping feet flat or in dorsiflexion
2. As you inhale, remove wedge from plates and rise up as high as you can where your feet are in plantar flexion
3. Exhale as you slowly bring feet back to starting position

IV. Safety Cues and Corrections

-Make sure to maintain a flat back and knees stationary
-Makes sure thighs and back remain in constant contact with their respective pads

Error	**Correction**
You cannot control the raising and lowering of the weight.	• Choose a weight allows you to control the speed of the movement. • Both the lifting and lowering phase should be slow and controlled.
You do not complete a full range with leg extensions.	• Begin with your thigh and lower leg forming a 90 degree angle. • Do not allow your ankles to pass behind your knees.

	• Raise the weight until your legs are straight but not locked.
You do not complete a full range with leg curls.	• Begin with your legs at a point where they are straight but not locked. • Curl the weight, bringing your feet towards your buttocks. • Do not stop until your legs are flexed at least 90 degrees.
Your back and/or buttocks lifts off the pad.	• Lighten the load. • Concentrate on keeping your back and buttocks against the bench or pad.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #11 Completed_____

Module #12 Chest

I. Introduction

Having a strong chest is important for good posture and many sporting activities. However, too often people concentrate too much on this body part and a strength imbalance can occur. This can lead to poor posture, back pain, and shoulder issues. Keep this in mind as you are thinking about your own person workout. For the chest, the bench press and incline press are considered core exercises. Think about which of the exercise below are multi-joint and single-joint.

II. Warm-up

We are going to do light intervals for our warm-up. Begin by jogging from one baseline to the other and back, and then walk down to the other end. Go about 40-50% effort. Repeat three times increasing your intensity each time. When done, do 10 pushups at a slow pace. By going slower, we actually can get a stretch in as well. Do two stretches for the lower body.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Bench Press	Shoulder Adduction (horizontal) Elbow Extension	Pectoralis major	Anterior deltoid Triceps brachii
Incline Press	Shoulder Adduction Elbow Extension	Pectoralis major	Anterior deltoid Triceps brachii
Dumbbell Press	Shoulder Adduction (horizontal) Elbow Extension	Pectoralis major	Anterior deltoid Triceps brachii
Dumbbell Fly	Shoulder Adduction (horizontal)	Pectoralis major	Anterior deltoid

Incline Dumbbell Press	Shoulder Adduction (horizontal) Elbow Extension	Pectoralis major	Anterior deltoid Triceps brachii
Cable Crossover Fly	Shoulder Adduction (horizontal)	Pectoralis major	Anterior deltoid

Bench Press:

1. Lie flat on a bench, with eyes directly below bar on rack. Grip bar slightly wider than shoulders with closed, pronated grip
2. Begin by lifting bar off rack and positioning bar over chest with arms fully extended
3. Lower bar slowly with elbows moving slightly away from the body until the bar lightly touches the chest
4. Press bar slowly up and slightly backwards until elbows are fully extended, but not locked

Incline Press:

1. Sitting on an incline bench with head resting at top, grasp bar with closed pronated grip slightly wider than shoulders
2. Begin by positioning bar over upper chest with elbows fully extended
3. Lower bar slowly, guiding it towards the upper chest until it lightly touches chest
4. Raise bar slowly, making sure not to raise lower back off bench, until elbows are extended, but not locked, and once again at starting position

Dumbbell Press:

1. Lie flat on bench with feet on floor, dumbbells held directly over chest, where arms are fully extended, but not locked
2. Lower dumbbells slowly towards chest, keeping hands aligned, and out towards lateral sides of chest, until hands are slightly above chest level
3. Press dumbbells upwards until elbows are fully extended and return back to starting position

Dumbbell Flys:

1. Lie flat on bench, feet on floor, grasping dumbbells with closed pronated grip
2. Extend arms until elbows are at about 110 degrees
3. Begin by lowering dumbbells in a slight outward motion from the body until elbows reach shoulder level
4. As you exhale, push dumbbells slowly back to starting position

Incline Dumbbells Press:

1. Sit on an incline bench, resting head back on pad, grasping dumbbells in a closed pronated grip
2. Hold dumbbells with arms fully extended, but not locked, over upper third of chest
3. Begin by lowering dumbbells as you inhale, making sure not to let them flare to the sides, until the arms are at a 90 degree angle
4. As you exhale, push dumbbells back slowly to starting position

Cable Crossover Flys:

1. Standing between the cable machines with sides and arms of body facing them, grip cable handles with palms facing sides of body and elbows slightly bent. Make sure that knees are slightly bent with feet slightly wider than shoulder-width apart, and that your back is bent over about 45 degrees
2. Begin by pulling cables in close towards body right below chest level, without flexing or extending elbows, until hands just barely meet
3. Gradually let arms back out to starting positioned with controlled movements

IV. Safety Cues and Corrections

-Make sure to keep your grip on the weight both ends are secured
-When holding weight, lower one at a time to place on floor when lying on back

Error	**Correction**
You cannot control the weight.	• Choose a weight that you can not only lift but control. • Make sure the weight is moving slowly.
Your grip is not evenly spaced.	• Adjust the hands so they are equidistant from the plates. • As you lower the weight, your upper arm and forearm form a 90 degree angle (L-shape). • After the weight is lowered, your wrists should be directly over your elbows.
Your elbows extend unevenly.	• Concentrate on the arm that lags behind. • Choose an object straight ahead focus on instead of looking your arms.

Your back and/or buttocks lifts off the pad.	• Lighten the load. • Concentrate on keeping your back and buttocks against the bench or pad.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #12 Completed_____

Module #13 Back

I. Introduction

Next to our legs, our back has the strongest muscles of the body. It is important to maintain good strength balance between the chest and back. Strong back muscles help with good posture, reduce the possibility of shoulder injuries, and like the chest, are very helpful in many physical activities. The module will show you some of the basic exercises needed to have a strong back.

II. Warm-up

Do a nice easy 4 laps around the gym and stretch using 3 upper body and 3 lower body stretches.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Chin-Ups	Shoulder adduction Shoulder Extension Elbow flexion	Latissimus dorsi	Posterior Deltoid Biceps Brachii
Lat Pull-Downs	Shoulder adduction Shoulder Extension Elbow flexion	Latissimus dorsi	Posterior Deltoid Biceps Brachii
Seated Rows	Scapular retraction Shoulder Extension Elbow flexion	Rhomboids Trapezius	Posterior Deltoid Biceps Brachii

One-Arm Dumbbell Rows	Scapular retraction Shoulder Extension Elbow flexion	Rhomboids Trapezius	Posterior Deltoid Biceps Brachii
Bent Rows	Scapular retraction Shoulder Extension Elbow flexion	Rhomboids Trapezius	Posterior Deltoid Biceps Brachii
Barbell Shrugs	Scapular elevation	Trapezius	
Dumbbell Shrugs		Trapezius	

Chin-Ups:

1. Start by gripping the chinning bar with a wide, overhand grip and extended arms
2. As you inhale, pull yourself upwards until your chin is level with the bar
3. Slowly lower yourself back to starting position with controlled muscle movements

Lat Pull Down:

1. Sit facing machine with your knees under pads. Grasp pull down bar with overhand grip a little wider than shoulders.
2. As you inhale, pull bar down close to face towards your upper chest until the bar reaches right below chin level
3. As you exhale, let bar ascend until arms are extended, but not locked

Seated Rows:

1. Sit facing machine with knees slightly bent and feet on pads. Grasp cable handles with closed, pronated grip
2. Keeping back upright as you inhale, pull cables toward you at chest level until elbows are just behind back and hands are even with chest
3. As you exhale, extend arms slowly until they are straight, but not locked

One Arm Dumbbell Rows:

1. With knee opposite side of arm performing exercise on bench, and same arm extended palm down on bench, place dumbbell in opposite hand and let hang freely with arm extended
2. Inhale as you begin to flex arm up and back, keeping elbow close to body until at a 90 degree angle
3. As you exhale, slowly extend arm back to starting position

Bent Rows:

1. Standing with your knees slightly flexed, and back straight, but bent over at a 45 degree angle, grasp bar with pronated grip slightly wider than shoulder shoulder-width apart
2. As you inhale, pull bar towards abdominals until it lightly touches tem
3. As you exhale, slowly lower bar back to starting position

Barbell Shrugs:

1. Stand erect with feet shoulder-width apart and hands grasping barbell slightly wider than shoulders with an overhand grip
2. Begin by inhaling and shrugging shoulders as far back and as high as possible
3. Exhale and lower barbell back to staring position

Dumbbell Shrugs:

1. Standing erect with hands grasping dumbbells with palms towards in to sides of body
2. Begin by inhaling and shrugging your shoulders as high and as far back as possible
3. Exhale and lower dumbbells back to starting position

IV. Safety Cues and Corrections

-Make sure not to jerk torso or lean back quickly when pulling the weight
-Make sure not to extend knees or allow your body's weight to shift toward your toes

Error	**Correction**
Your upper back is rounded.	• Lift your head up and look straight forward.
Your upper body moves as you lift the weight.	• Look in a mirror and watch your form. • Maintain a stable body position. • Be sure that movement only occurs at the back and elbows as you pull the weight towards your body.
Your torso is not erect.	• Keep your abdominals and lower back muscles tight.
You do not complete a full range of motion.	• Choose a lighter weight. • For rowing movements, pull your elbows back and push your shoulder blades together.

	• For pulldowns, pull your elbows towards your ribs.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #13 Completed_____

Module #14 Shoulders

I. Introduction

The shoulders are an interesting muscle group. With the instability of the shoulder joint, these muscles have the role of not only supporting the arm and keeping it in place; it provides the greatest amount of motion of almost any joint in the body. Strong shoulders help prevent injuries and allow us to do many overhead activities.

II. Warm-up

Grab a jump rope. Do 2 minutes of jumping followed by 30 seconds of rest. Repeat twice. Don't forget to stretch. Do a total of five stretches.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Front Press	Shoulder abduction Elbow extension	Anterior deltoid Medial deltoid	Triceps brachii
Dumbbell Press	Shoulder abduction Elbow extension	Anterior deltoid Medial deltoid	Triceps brachii
Lateral Raises	shoulder abduction	Medial deltoid	
Bent-Over lateral Raises	Shoulder extension	Posterior deltoid	
Front Raises	Shoulder flexion	Anterior deltoid	
Upright Rows	Scapular elevation Shoulder abduction Elbow flexion	Trapezius	Anterior deltoid Biceps brachii

Front Press:

1. Sit on bench with back straight taking an overhand grip on the barbell slightly wider than shoulder-width apart, letting bar rest on upper chest
2. Begin by inhaling and raising bar above head until arms are extended, but not locked
3. Exhale and slowly bring barbell back to starting position

Dumbbell Shoulder Press:

1. Sit on a bench with your back straight, grasping dumbbells with an overhand grip, lifting them to your shoulders with your elbows to the sides and slightly below shoulder-height
2. Inhale and press dumbbell upwards until arms are extended, but not locked
3. Exhale and bring dumbbells back to starting position

Lateral Raises:

1. Standing with your feet shoulder-width apart and your back straight, grip dumbbells over-handed with palms facing sides of body
2. As you inhale, bring dumbbells to shoulder level keeping your elbows slightly bent
3. Exhale as you lower dumbbells back to starting position

Bent-Over Lateral Raises:

1. Standing with your feet shoulder-width apart and your back bent forward letting dumbbells hang freely below chest
2. Inhale and bring dumbbells directly out to your sides keeping your arms extended, but not locked
3. Exhale as you lower dumbbells slowly back to starting position

One-Dumbbell Front Raises:

1. Standing with your feet shoulder-width apart and your back straight, grasp dumbbells with overlapping inward grips while holding out front of your body at lower abdominal level
2. Inhale and raise dumbbell to shoulder height keeping arms extended, but not locked
3. Exhale and slowly bring dumbbell back to starting position

Upright Rows:

1. Standing with your feet shoulder-width apart, grasp barbell with overhand, pronated grip with arms extended and resting right below waist level
2. Inhale as you bring barbell to chin level, letting elbows rise at the sides to shoulder level
3. Exhale as you slowly bring barbell back to starting position

IV. Safety Cues and Corrections

-Make sure not to bounce or jerk the handles as they reach the shoulders as to help spring weight stack up
-Make sure not to arch lower back, raise hips, or tilt head too far backwards

Error	**Correction**
Your grip is not evenly spaced.	• Adjust the hands so they are equidistant from the plates. • As you lower the weight, your upper arm and forearm form a 90 degree angle (L-shape). • After the weight is lowered, your wrists should be directly over your elbows.
Your elbows extend unevenly.	• Concentrate on the arm that lags behind. • Choose an object straight ahead focus on instead of looking your arms.
Your upper body moves as you lift the weight.	• Look in a mirror and watch your form. • Maintain a stable body position. • Be sure that movement only occurs at shoulder joint. • Movement can also occur at the elbow during pressing movements.
You cannot control the raising and lowering of the weight.	• Choose a weight allows you to control the speed of the movement. • Both the lifting and lowering phase should be slow and controlled.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use

light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #14 Completed_____

Module #15 Biceps

I. Introduction

Too many individuals concentrate on the biceps as the ONLY muscle group that needs to be worked on. As you have learned, that is FAR from the truth. Not to give the biceps a bad name, they do play a role in fitness, especially in several sport activities.

II. Warm-ups

This warm-up is a little different. Have you ever heard of running lines? Or gassers? Same concept, but lower the intensity. Remember that the warm-up is supposed to do just that, warm you up. Start at the baseline and jog to the free throw line and back. Now jog to half court and back. Next, to the far free throw line and back. Finally, all the way to the other baseline and back. Take a 30 second break. Repeat two more times. Do five stretches.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Dumbbell Curls	Elbow Flexion	Biceps Brachii Brachialis	Brachioradialis
Hammer curls	Elbow Flexion	Brachialis	Biceps Brachii Brachioradialis
Barbell Curls	Elbow flexion	Biceps Brachii	Brachialis Brachioradialis
Preacher Curls	Elbow Flexion	Biceps Brachii	Brachialis Brachioradialis

Dumbbell Curls:

1. Begin with elbows fully extended, allowing dumbbells to hang at sides of body facing outer thighs
2. Inhale raising one arm at a time, turning the palm up
3. Elbows should remain stationary against side of torso as dumbbell is raised
4. Elbow fixed at highest dumbbell position indicates proper range of motion

Hammer Curls:

1. Begin as you would with dumbbell curls; Elbows fully extended, dumbbells hanging at sides of body facing outer thighs
2. Inhale raising one arm at a time, keeping palm in same position
3. Elbows should remain stationary against side of torso as dumbbell is raised
4. Once elbow is flexed at highest point without moving forward, gradually allow dumbbell to slowly descend until arms are once again fully extended

Barbell Curls:

1. With arms touching side of the hips, grasp bar with arms supinated, torso erect and shoulders held back
2. Bar should be positioned on front of hips, knees slightly flexed, and feet shoulder width apart
3. Inhale, raising bar by flexing at elbows, keeping arms and elbows stationary against sides of torso
4. Once elbows are flexed at highest point without moving forward, allow the bar to slowly descend until arms are fully extended

Preacher Curls:

1. Sit, placing elbows over padding with hands supinated gripping bar
2. As you inhale, pull bar towards body keeping elbows in place
3. Once elbows have reached full flexion, slowly descend bar until elbows are fully extended

IV. Safety Cues and Corrections

-Make sure to allow breaths with each individual repetition
-Weight should not swing up or out of control
-Keep erect upper body position

Error	**Correction**
Your upper arms move backward.	• Keep your elbows over your hips. • Press the inside of your elbow into your ribs.
Your wrists roll back as you lower the weight.	• Keep your wrists locked and slightly flexed.
You have to sway your body to complete the last rep.	• Keep your abdominal and lower back muscles tight. • Stand against a wall.
You do not complete a full range of motion.	• As your lift the weight, curl upwards, bringing your hands to your shoulders.

	• Lower the weight until your elbows are extended.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Module #15 Completed_____

Module #16 Triceps

I. Introduction

The triceps muscle group is located on the posterior area of your arms. We don't see them that often, but they serve an important role. Imagine not having them. You would be able to flex your arm with your biceps, but then you couldn't extend them. That would look weird. Several activities require strong triceps. Think about pushups and other chest exercises. Could you do them without your triceps?

II. Warm-ups

Jog 4 laps around the gym and then complete 6 stretches.

III. Exercises

Read the information below and examine the pictures associated with each exercise. Then grab the appropriate DVD and watch the demonstrations for each exercise. Refer back to this information if you have any questions.

Exercise	**Muscle Action**	**Primary Muscles**	**Secondary Muscles**
Push Downs	Elbow Extension	Triceps brachii, Lateral head	Triceps brachii, medial and long heads
Reverse Push Downs	Elbow Extension	Triceps brachii, Lateral, medial, and long head	Anconeous
Triceps Extensions	Elbow Extension	Triceps brachii, Lateral head	Triceps brachii, medial and long heads
Seated Dumbbell Triceps Extension	Elbow Extension	Triceps brachii, Long head	Triceps brachii, medial and lateral heads
Triceps Kickbacks	Elbow Extension	Triceps brachii, medial head	Triceps brachii, lateral and long heads

Push Downs:

1. Stand erect, facing machine with feet shoulder-width apart, elbows against sides of body, arms bent at 90 degree angle, and hands pronated gripping bar
2. Push bar down towards ground, making sure to keep body straight and shoulders squared, with elbows remaining at sides
3. Once arms are fully extended, gradually let bar ascend until elbows are once again at 90 degree angle

Reverse Pushdowns:

1. Stand erect facing machine, feet shoulder-width apart, elbows resting against sides of body, elbows bent at 90 degree angle with hands supinated gripping bar
2. Inhale as you begin to pull arms downward and extend elbows
3. Once arms are completely extended, gradually let bar ascend until elbows are once again at 90 degrees

Triceps Extensions:

1. Lie with back flat on bench, elbows fully extended, arms straight up in air taking an overhand grip on bar
2. Inhale as you bend your elbows, keeping them pointed towards the ceiling, making sure not to allow them to flare to the sides
3. Once bar is almost touching forehead, keeping upper arms and elbows stationary, press the bar upward and slow by extending elbows until arms have reached full extension once again

Seated Dumbbell Triceps Extensions:

1. Sitting at the end of a bench with feet flat, grasp dumbbell with thumb and index finger supporting one end directly over head
2. With arms parallel to each other, pressing against ears, allow elbows to face the same direction as your eyes are focused
3. Keep upper arms next to ears and head as you begin to press dumbbell upwards, extending your elbows to starting position

Tricep Kickbacks:

1. Start with knees slightly bent, shoulder-width apart, back bent parallel to floor
2. Placing upper arm against body, bend elbow to 90 degree angle and allow dumbbell to hang freely
3. As you inhale, push dumbbell backwards, fully extending arms, keeping elbows against body
4. Exhale as you bring dumbbell back to starting position and elbow is once again at 90 degrees

IV. Safety Cues and Corrections

-Make sure to keep your head in a neutral position and not to flex it
-Be careful to maintain erect posture while sitting on edge of a bench
-Be careful not to lock elbow joints when in weight is in bottom position

Error	**Correction**
Your elbows bow out or away from your body uncontrollably.	• Keep your elbows over your hips. • Keep your forearms parallel to each other. • Limit movement to the elbow joint for all exercises.
You do not complete a full range of motion.	• Begin with your upper arm and forearm forming a 90 degree angle (L-shape). • Continue to extending your elbow until it straightens completely.
The weight moves rapidly and uncontrollably during the lowering phase.	• Slowly return your extended arm to a 90 degree angle. • Choose a weight that you can not only lift but control. • Make sure the weight is moving slowly during the entire movement.
Your upper body moves back and forth.	• Maintain a stable body position. • Your head, shoulders, and hips should form a straight line.

V. Task

For this and other **Skills Modules,** you will need to successfully demonstrate at least three of the exercises. Practice all of the exercises with a partner until you feel confident that you can receive a *Satisfactory* on any three exercises. A *Satisfactory* means that you can demonstrate the correct way to do the exercise and be able to explain the safety issues.

As you are practicing, record your exercises on the **My Routine** form at the end of the workbook. Include the exercise, the day you did it, and the weights and reps. Remember that during your practicing, use

light weights so that you can master the technique needed for safe lifting.

When you are ready, take the **My Exercise Checklist** form and have your teacher evaluate your performance and give a score of on three different exercises in order to progress to the next module. If you receive an *Unsatisfactory*, you will need to go back and review and practice and try again.

Complete the push-down, extension, and kick back exercises. Do a set of 12 reps using light weights for each exercise. Even though they work the same muscles, these exercises work the muscles from different angles. Describe the different feelings you have as you complete them.

_____
_____
_____
_____
_____
_____

Module #16 Completed_____

Fitness Profile

Name: _____

Pre-Assessment date: _____

Post-Assessment date: _____

Fitness Test	Males	Females	My Score (Pre-Assessment)	My Score (Post-Assessment)
BMI	*25.0-16.1*	*30.4-14.0*		
PACER	*41 – 94*	*23 – 61*		
Curl-Up	*≥ 24*	*≥ 18*		
90^0 Push-Up	*≥ 16-35*	*≥ 7*		
Sit and Reach* (inches)	*8*	*12*		

Give a summary of your overall fitness level based on your pre-assessment.

_____

_____

_____

_____

_____

_____

Give a summary of your overall fitness level based on your post-assessment.

_____

_____

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_____

_____

My Exercise Checklist

Name: _____

Exercise	Performance[1]	Safety[1]	Comments[2]	Scorer's Initials and Date

1- Scores must be Satisfactory (S) to write the exercise on the *My Routine* form.
   a. Satisfactory (S)
      i. performs all performance or safety cues correctly
      ii. chooses an appropriate weight
   b. Unsatisfactory (US)
      i. does not perform all performance or safety cues correctly
      ii. needs practice before next attempt
2- If the attempt receives an unsatisfactory (U) score, list the specific performance or safety cues that were not demonstrated.

My Exercise Checklist

Name: _____

Exercise	Performance[1]	Safety[1]	Comments[2]	Scorer's Initials and Date

1- Scores must be Satisfactory (S) to write the exercise on the *My Routine* form.
   a. Satisfactory (S)
      i. performs all performance or safety cues correctly
      ii. chooses an appropriate weight
   b. Unsatisfactory (US)
      i. does not perform all performance or safety cues correctly
      ii. needs practice before next attempt
2- If the attempt receives an unsatisfactory (U) score, list the specific performance or safety cues that were not demonstrated.

My Exercise Checklist

Name: _____

Exercise	Performance[1]	Safety[1]	Comments[2]	Scorer's Initials and Date

1- Scores must be Satisfactory (S) to write the exercise on the *My Routine* form.
   a. Satisfactory (S)
      i. performs all performance or safety cues correctly
      ii. chooses an appropriate weight
   b. Unsatisfactory (US)
      i. does not perform all performance or safety cues correctly
      ii. needs practice before next attempt
2- If the attempt receives an unsatisfactory (U) score, list the specific performance or safety cues that were not demonstrated.

MY ROUTINE

Name: ______________________

Muscle/Exercise	Day	Sets	Repetitions	Weight

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